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ABSTRACT

In 1962 the Optical Society of America (OSA) established the Needs in Optics Committee for the purpose of increasing the national supply of personnel trained in optics. In order to carry out this program, the problem was broken down into six tasks, one of which was concerned with Undergraduate Research Programs. The Task IV group convened more than 80 individuals interested in research in Optical Physics at the undergraduate level. These conference representatives from numerous institutions were provided an opportunity to exchange information and to learn about recent developments in modern Optical Physics. They also provided information to Task IV about ways it could be of assistance to them. Recommendations of the Conference for programs in direct support of college research efforts include: (1) establishment of a communication between OSA and faculty members; (2) establishment of an "Optics Research Newsletter"; (3) development of an "Optical Handbook"; (4) production of a summary of information related to grants and contracts; (5) development of listings for summer employment; (6) dissemination of information about the present status of optics teaching; and (7) addition of an Education Officer to the Executive Office Staff. (Author)

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OPTICAL SOCIETY OF AMERICA

1155 Sixteenth Street, N.W.
WASHINGTON, D.C. 20036

REPORT TO THE
NATIONAL SCIENCE FOUNDATION
ON THE
CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS
HELD AT SOUTHWESTERN COLLEGE (MEMPHIS, TENNESSEE)
JUNE 8-12, 1964.

Prepared by:
V. Z. Williams
Director, Optics - an Action Program
J. H. Taylor
Leader, Task IV (Undergraduate Research Programs)

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REPORT TO THE NATIONAL SCIENCE FOUNDATION
ON THE CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS
HELD AT SOUTHWESTERN COLLEGE, JUNE 8-12, 1964.

I. Background

For some time now the Board of Directors of the Optical Society of America has been concerned with the status of Optics in the United States. At the Spring 1962 Meeting of the Optical Society of America the Board formed the Needs in Optics Committee to study this problem. The membership of this Committee consisted of the following: Mary E. Warga, D. L. MacAdam, V. Z. Williams, S. S. Ballard, W. R. Brode and H. S. Stewart. The Committee was under the Chairmanship of V. Z. Williams. As a result of its study this Committee formulated its "Optics - an Action Program" also headed by Dr. Williams (See Attachment A). Dr. Mary E. Warga, Executive Secretary of the Optical Society and J. A. Sanderson, Board of Directors, represent the Society as a whole in the program. The chief purpose of this program is to increase the national supply of personnel trained in Optics. In order to carry out the program the over-all problem was broken down into six Tasks. Task IV, Undergraduate Research Programs, was headed by J. H. Taylor, Professor of Physics, Southwestern At Memphis.

On November 1, 1963, a letter (See Attachment B) was sent to the Chairman of each Physics Department that offers a Bachelor of Science degree in Physics describing the purpose of Task IV and also inquiring as to whether or not they were interested in starting research in Optical Physics. In addition to this letter, there was also enclosed in this mailing a copy of "Optics - an Action Program" (See Attachment A), copy of

"Optical Physics Research in a Small Liberal Arts College" (See Attachment C) and a self addressed, stamped questionnaire post card (See Attachment D).

The response to this first mailing was most encouraging. A total of 284 questionnaire post cards were received at the Optical Society of America. From these cards the following data were obtained:

Number of colleges or universities interested in initiating a program of research in the field of Optical Physics or closely related subjects	188
Not interested	59
Number of colleges or universities interested in helping Task IV even though the college or university was already doing research in Optical Physics or a closely related subject	77
Not interested in helping Task IV	15
Number of colleges or universities currently pursuing research in Optical Physics or some closely related subject	100
Number of colleges or universities offering a course in Optics	
Yes	260
No	19
Course Required	129
Course Optional	99

A Map showing the geographical distribution of those colleges and universities interested in initiating research is presented in Attachment E. The majority of these represent the smaller size physics departments.

On February 19, 1964, a second mailing was made to those who had expressed interest on the first questionnaire. This mailing consisted of a letter (See Attachment F), a list of discussion group areas (See Attachment G), an application blank for attendance at the Conference On Undergraduate Research Programs in Optical

JUL 5

Physics (See Attachment H) and a self-addressed acknowledgment post card (See Attachment I).

II. Conference on Undergraduate Research Programs in Optical Physics

The request for attendance at this Conference exceeded by far our expectation. There were 106 requests for attendance. From this number, 80 were selected.

It should be pointed out that this Conference was most enthusiastically received. Many letters were received from professors in the various colleges and universities saying that although they would be unable to attend, for one reason or another, they were most interested and asked to receive copies of the results of the Conference. At least two graduate universities, each a great center of Optical Physics research, asked if they could send some of their graduate students at their own expense. This permission was granted. The Infrared Group at Cape Kennedy asked for permission to send someone at their expense. Similarly, a small non-profit research laboratory engaged often in Optical Physics research sought permission. Both of these were granted.

As stated previously only 80 of the 106 requesting admission to the Conference were accepted. It should be pointed out, however, that several of the remaining attended at their own expense.

Each of the 80 Participants was assigned to either one of the Research Groups I - V or Supporting Aspects of Research Groups A - C. On April 19, 1964, the Participants were notified by letter (See Attachment J) of their acceptance to attend the Conference. The 26 who were not accepted were notified by letter (See Attachment K) on May 23, 1964. The Official Participant Attendance List (ie, those Participants who received expenses) is enclosed (See Attachment L). The attendance at the Conference (other than official Participants and Invited Lecturers) is shown on

Attachment M, and the list of all of the professors who expressed a desire to attend the Conference is shown on Attachment N.

Prior to the Conference the Participants were broken down into groups (I - V and A - C). Each Group had a Chairman and Vice-Chairman. The various group chairmen were notified by letter (See Attachment O) on April 19, 1964, that they had been chosen to serve as chairman. The vice chairmen were similarly notified by letter (See Attachment P) on April 19, 1964. A listing of the various Chairmen and Vice-Chairmen is enclosed (See Attachment Q).

There were 23 Invited Lecturers. A list of the Invited Lecturers and their Lectures is enclosed (See Attachment R). The Invited Lecturers were notified by letter (See Attachment S) on April 19, 1964, that the proposal submitted by the Optical Society of America to the National Science Foundation for the Conference had been approved.

A letter (See Attachment T) was sent on April 19, 1964, to the Corporation Members of the Optical Society of America asking them to send educational or pedagogical literature in the general field of Optical Physics for distribution to the Conference Participants. Their response was most heartening. The following Corporation Members of the Optical Society of America sent material for distribution to the Participants:

Eastman Kodak Company

Aerospace Corporation

Barnes Engineering Company

Spectra-Physics, Incorporated

The Ealing Corporation

Jenaer Glaswerk Schott and Gen., Mainz (western Germany)

I.B.M. Watson Research Center

Bausch and Lomb, Incorporated

Block Associates, Incorporated

American Optical Company
Chicago Aerial Industries, Inc.
Sawyer Research Products, Inc.
Perkin-Elmer Corporation
Central Scientific Company
Edmund Scientific Company

A copy of the Conference program is enclosed (see Attachment U).

On June 5, 1964, the American Institute of Physics published a News Release on the Conference (see Attachment V).

III. A Profile of the Conference Participants

The 106 who requested attendance at the Conference were asked to express a preference for participation in Groups I - V and A - C. Their first choices for Research are shown in Figure 1 and for Supporting Aspects in Figure 2. It should be pointed out that this was their research preference before the Conference. Their preference for research has not been checked since the Conference.

Figure 3 is a plot of the colleges and universities interested in attending the Conference vs. the number on the physics staff.

In order to help determine the present status of Optical Physics at the undergraduate level the Participants were asked to fill out a questionnaire (see Attachment W) during the Conference. It is the intention of Task IV to follow up on this with another questionnaire in approximately one year in an attempt to determine whether or not any research progress was made as a result of the Conference. As a result of answers to this questionnaire considerable information was obtained concerning the Participants and their courses in Optical Physics.

Figure 4 is a plot of the age distribution of the Participants. It is encouraging to see that the majority of them are relatively young with several years of teaching remaining. The importance of this to the future of undergraduate Optics teaching should not be overlooked. The highest degree held by the Participants is shown in Figure 5. Also shown in this Figure are some of the support facilities the Participants have.

Figure 6 gives information concerning the undergraduate Optics courses which are at present included in the curricula of the colleges represented at the Conference. Figure 7 deals with the laboratory course in Optics as well as advanced undergraduate courses in Optics. It is interesting to see that about 25% give a course in Optics at a level above that of say, Jenkins and White. The last plot in this Figure shows that previously there had not been such a course in the great majority of the colleges and universities.

Figures 8 and 9 give information on the texts used as well as the sources of Optics experiments. Most of the colleges and universities represented at the Conference have some mechanism to enable a student to perform laboratory work beyond that which is usually considered pedagogical. This is shown in Figure 10.

Figure 11 is concerned with the question of whether or not there is lack of interest in Optical Physics on the part of undergraduates, research in Optical Physics and the utilization of government surplus equipment. It is encouraging to note that about 25% of the Participants at the Conference are engaged in research in Optical Physics.

The amount of time devoted in the undergraduate Optics course to geometrical, physical and special topics is shown in Figure 12.

On the questionnaire the Participants were asked to list what they considered to be the chief obstacles they faced in doing research. These are shown in Figure 13.

During the Conference a trial questionnaire was worked up by Dr. M. E. Warga (Leader, Task V) and Group C. This questionnaire was also distributed and the data from two of the questions are shown in Figures 14 and 15.

IV. Reports of Groups I - V and A - C.

Included herein are the reports of the various Groups. Although the reports have been re-typed, a minimum of editing has been done.

V. Summary of Conference on Undergraduate Research Programs in Optical Physics.

The success or failure of a Conference such as this is difficult to evaluate. Certainly considerable effort went into trying to insure its success. Task IV will poll the Participants in about a year to check on progress. The Conference did provide an opportunity to assemble together, and get to know, those who are interested in research in Optical Physics at the undergraduate level. Task IV now knows something about these Participants. Perhaps Optics is not in as bad a situation as some people thought. The Conference provided an opportunity for education in modern Optical Physics, thanks to the Invited Lecturers. In addition, many ideas for research projects were put forth. Also, the Participants had an opportunity to make known to Task IV some of the ways in which they can be helped in the field of Optical Physics.

Although some of the suggestions from the Groups were probably unrealistic, there nevertheless is one very obvious point that runs throughout, namely, they expect the Optical Society of

America to take a more active leadership. There is also the repeated request for an opportunity to update their education in modern Optical Physics.

VI. Recommendations of the Conference for Programs in Direct Support of the College Research Efforts.

In addition to the technical programs of Section IV, the Support Groups A, B, and C and some of the Research Program Groups made suggestions and recommendations for OSA action. There was also considerable discussion of the problems of the small college physics professor. Just prior to the Conference there appeared in the May issue of PHYSICS TODAY a summary of the COPFIC (Committee on Physics Faculties in Colleges) Report. The college faculty problems brought out in that excellent report and some of the recommendations for their alleviation are similar to those the Conference reported. Since the COPFIC Report is widely available, this section is concerned only with possible action steps specific to optics.

1. Research Communication

A specific communication mechanism was proposed whereby the OSA could provide a linkage so that a member of any physics faculty desiring aid or advice in a specific area of optics could be recommended to a competent researcher in that field for such help.

A proposal for consideration and appropriate action on a communication mechanism has been referred to the OSA Board.

2. Optics Research Newsletter

A common recommendation was the establishment of an Optics Research Newsletter for distribution to faculty members which would keep them aware of current developments in optics to aid their teaching and research studies. While the problem is not an easy one to handle, it was the conclusion of the Optics Action Group that a start on it should be made.

A proposal for consideration and appropriate action for preparation of such Optics Research Newsletter material has been referred to the OSA Board. The aspects of its dissemination and continuation will be developed in time.

3. "Optical Handbook"

The requirement of centralized availability or a "handbook" of optical characteristics of materials is strongly urged. This same requirement was by far the greatest single item listed in answer to the question of the Task III post card survey (to be reported separately). The question for the Optical Society would have two aspects - a philosophical one of its responsibility in the area and a practical one of what might be done about it.

This question is so fundamental to the Society, a proposal for consideration and appropriate action for naming a group to study this problem has been referred to the OSA Board.

4. Research Grants and Contracts

It was agreed that the Conference effort would produce a good summary of the present situations with respect to grants, contracts, and other financial aid from foundations or contracting agencies. The question of grants in the $500-$1000 area for critical items was a common one. This proved too complex for the circumstances.

The Optics Action Group working with the Executive Office is having such a summary prepared for later dissemination to the Conference Group.

It is emphasized that the OSA cannot become a clearing house for handling contracts, act as liaison in such regard, aid in writing research contracts, or distribute surplus equipment.

5. Summer Employment

Although this problem was much discussed, no specific scheme appeared which offered great advantage over present mechanisms. For the benefit of the Conference members, the following present mechanisms are listed:

(a) Program in Government Laboratories

This program for undergraduate Student Trainees is under the supervision of the U. S. Civil Service Commission. Announcements of examinations are available on request from the Commission or one of its regional offices. Examinations will be given in January and March 1965 in a number of places in each state. Appointments are made on the basis of performance in the examination the Civil Service grade level and salary depend on the number of years of college completed. These and other details are described in the announcements of the examinations.

Applicants who hold a bachelor's degree (therefore including faculty), or who expect to receive a degree in June of the summer in which they desire employment, are not required to take a written examination. They file an Application for Federal Employment, called Form 57, which is available at post offices, together with a list of courses completed and grades received.

These programs are nation-wide and the types of work, the number of summer vacancies, and other details vary somewhat between laboratories. Specific information should be sought by correspondence with the Civil Service Commission or direct with a particular laboratory of interest to the student or faculty member.

(b) NSF Programs

NSF provides summer and part time research programs for both undergraduates and college teachers. Details of these programs are available from the National Science Foundation, Division of Scientific Personnel and Education, Washington, D. C. 20550. Further information on these is given in Section VI - 4 of the report.

(c) AIP Program

The American Institute of Physics, under recommendation of COPFIC, maintains two listings. One shows the institutions and industries which welcome inquiries about summer employment for physics students and teachers. The other listing gives the names of physics faculty members who would like to consider such employment. Data on this program are available from the American Institute of Physics, 335 East 45th Street, New York, New York 10017.

6. Education in Optics

The recommendations of the Conference with regard to education are incorporated in the Task V program under M. E. Warga. In summary, the Conference felt the present status of optics teaching should be better known. A questionnaire for this purpose was prepared and put through a dry run of the Conference. It is being improved for distribution. Pending more accurate knowledge in this regard, the cognizant Group recommended that:

6 (a) The introductory physics course include material on optics which is at the level and extent of the text by Halliday and Resnick;

6 (b) Further course work be offered such that the level of optics instruction be at least in correspondence with the R-curriculum recommendations of the Second Ann Arbor Conference.

It was further felt that Task V and the OSA should increase the number of summer optics courses and institutes available.

7. Additional Manpower in the Executive Office

In subsequent consideration of this very successful Conference and its recommendations, it was realized that a most desired service is a means of informal and versatile communication in addition to the present communications via journals and meetings. The requirement is for a newsy, pointed communication concerning new research progress, correlation of available surplus equipment, new grants or assistance programs, summer employment opportunities, new undergraduate experiments in optics, a study of mass purchase of lasers for price improvement, etc.

Many of these things, as well as possible aid in a program for VI-3, might be pursued if the competence of an Education Officer might be added to the Executive Office staff.

The Optics Action Group recognizes the difficulties of getting and financing such a person and his expenses. On the other hand, the Society should give thought to all methods whereby it can better serve optics and its membership.

A consideration of this possibility has been referred to the OSA Board as a basis for starting discussion of these questions.

VII. Acknowledgment

Task IV would like to take this opportunity to acknowledge its appreciation to the Participants and others who have expressed interest in the program, to the Invited Lecturers and all the others who have given help and encouragement. The Invited Lecturers were asked to send copies of their Lectures in sufficient time to have them printed and distributed to the Participants during the Conference. This they did and their compliance is greatly appreciated.

Although the Conference schedule was extremely crowded and the Participants were kept very busy, they worked until midnight on Thursday (June 11) in order to get their various reports ready for typing during the wee hours of Friday morning. As a result of this extreme effort on their part the Group reports were ready for distribution to the Participants on the final day of the Conference.

The offices of the Optical Society of America also helped to prepare the proposals, mailing questionnaires, and indexing replies.

Finally, Task IV would like to express its appreciation to the National Science Foundation and the Office of Naval Research for financial assistance.

VIII. Financial Report

A Financial Report, prepared by Dr. Mary E. Warga, Executive Secretary, Optical Society of America, is provided in a separate document.

ATTACHMENTS

Attachment A has been removed.

Because of copyright restrictions,the following article has been omitted: "Optics-an Action Program," by Van Zandt Williams, Applied Optics*, Vol. 2, No. 6, June 1963, pp.653-656.

*The Optical Society of America, 1816 Jefferson Place, N.W., Washington, DC 20036

Attachment "B"

OPTICAL SOCIETY *of* AMERICA
EXECUTIVE OFFICE
1155 SIXTEENTH STREET, N.W.
WASHINGTON 6, D. C.
DISTRICT 7-6177

MARY E. WARGA
Executive Secretary

November 1, 1963

Chairman, Department of Physics

Dear Colleague:

This letter is being sent to the Chairman of each Physics Department that offers a Bachelor of Science degree in Physics. Although it is primarily aimed at the undergraduate colleges and universities, it is by no means limited to them.

There is a strong concern throughout the country about the lack of research personnel adequately trained in optics. This concern has led the Optical Society of America to undertake a program of improvement in the confident expectation that the endeavor will be a source of gratification to all who participate, especially to our students who are brought into this field. This program is described in detail in an article by Van Zandt Williams, which is enclosed.

The part of the program about which I am writing to you is Task IV, Undergraduate Research Programs. I have had some success in initiating such a program here at Southwestern College, and a reprint describing this activity is also enclosed. The Optical Society asked me to head Task IV, not with the intent of promoting mere duplication of the Southwestern program, but, rather, with the aim of promoting similar research activity within the broad spectrum of optical physics.

I think optical physics is an ideal field for undergraduate research programs. There are many possibilities that can be pursued with relatively simple and inexpensive apparatus. The purpose of this letter is to seek out those persons who are interested in initiating research in optics in the undergraduate curriculum. I am not trying to initiate a joint research activity. Rather, I am going on the assumption that a group of us acting together might better solve some of the difficulties we encounter in trying to do research within the framework of the undergraduate curriculum.

Some of the difficulties (and possible solutions) in initiating research programs that the group might want to consider are the following:

1. A Suitable Research Problem.

Those who have never taught in the small colleges may not fully appreciate this limitation. I, personally, feel that it is the chief deterrent to initiating a program of research, particularly on the part of those who have been away from graduate school and research activities for many years. Working as a group I think we could get researchers from the industrial, academic and government laboratories to suggest suitable problems for an undergraduate research program. To give just a few examples, I am confident that such optical physicists as John Strong of Johns Hopkins, John Sanderson of the Naval Research Laboratory, Robert Hopkins of the University of Rochester, Roderic Scott of Perkin-Elmer, John Howard of the Air Force Cambridge Research Laboratories and Shirleigh Silverman of the Office of Naval Research would be more than willing to meet with the group and discuss some suitable problems.

2. Equipment and Financial Support.

The group could be informed of the various government contracting agencies where research contracts might be obtained. Also, the possibility of support by the National Science Foundation in this effort might be discussed. The possibility of individual contracts might be strengthened by Optical Society of America or American Institute of Physics support.

Another possibility is the utilization of government surplus equipment made available in each state through the Department of Health, Education and Welfare. We have been most fortunate here at Southwestern in obtaining many pieces of optical apparatus through this outlet.

3. Summer Institute on Modern Optical Physics.

If the group thinks it desirable, we could try to organize an NSF sponsored teaching Institute for undergraduate teachers of Optics. Such a course might be entitled "Re-Education in Physics of the Electromagnetic Spectrum." The idea would be to get as many undergraduate teachers of Physics as possible to participate, making sure that among those who do participate would be those people interested in starting an undergraduate research program in Optics.

4. Summer Employment for Undergraduates Interested in Optical Physics.

We might work out with the optics industry, with the Optical Society of America as coordinator, a mechanism for getting our students summer jobs which will enhance their interest in this field and tend to pull them into our own programs. Such a possibility has already been investigated by certain members of OSA and they feel it is quite feasible if we can guarantee good students.

If you are interested in initiating a program of research in this field, I would appreciate your filling out the enclosed postcard. If you are already doing research in this field, but would like to help us in this program, I would appreciate it if you would also fill out the postcard, immediately, if possible.

If I can get a reasonable response of interest, we can then consider the questions more carefully before any final commitments.

Thanking you for your consideration in this matter, I am

Yours very truly,

J. H. Taylor

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Attachment C has been removed.

Because of copyright restrictions, the following article has been omitted: "Optical Physics Research in a Small Liberal Arts College," by J.H. Taylor, Applied Optics*, Vol. 10, No. 10, October 1963, pp. 1075-1079.

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* The Optical Society of America, 1816 Jefferson Place, N.W., Washington, DC 20036

Attachment "D"

OPTICAL SOCIETY OF AMERICA

Optics - Action Program - Task IV

1. Are you interested in initiating a program of research in the field of optical physics or closely related subjects?

   _____Yes   _____No

2. (a) If you are already pursuing research in this field, would you be interested in helping the OSA program to encourage more activity in this field in the undergraduate curriculum?   _____Yes   _____No

   (b) What field of research in optical physics or closely related subject is currently being pursued in your department? ______________________________

   ____

3. Does your Physics Department teach a separate undergraduate course in optics?   _____Yes   _____No   _____Required

   _____Optional

4. Name of person filling out this Questionnaire.

   ____

   Name of College (or University) ____________________

   ____

Attachment E has been removed.

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* Denoyer-Geppert Co. 5235 Ravenswood Ave., Chicago, IL,60640.

Attachment "F"

OPTICAL SOCIETY of AMERICA
EXECUTIVE OFFICE
1155 SIXTEENTH STREET, N. W.
WASHINGTON, D. C. 20036
DIstrict 7-6177

MARY E. WARGA
Executive Secretary

PATRICIA R. WAKELING
Assistant Secretary

February 19, 1964

J. H. Taylor
Professor
Department of Physics
Southwestern at Memphis
Memphis 12, Tennessee

Dear Professor Taylor:

On the recent questionnaire postcard sent out by Task IV of "Optics - An Action Program" you indicated an interest in starting or strengthening a research or an honors program in Optical Physics.

The returns on the questionnaire have been most encouraging. At the time of this writing, 251 replies have been received. Of this number, 168 have indicated a desire to start a research program in Optical Physics and there are others who already have programs but would like to participate in some joint effort.

In view of the interest shown by so many in Task IV, we have proceeded to the next phase of the program. On January 2 and 3, Drs. Mary Warga, Van Zandt Williams, John Sanderson and I met at the Optical Society headquarters in Washington and planned a "Conference on Undergraduate Research Programs in Optical Physics" to be held at Southwestern College (Memphis, Tennessee) on June 8-12, 1964. The primary purposes of the Conference will be the following:

1. To provide the Participants with ideas suitable for both research and honors projects.
2. To bring the Participants up to date on activities in modern Optical Physics.
3. To discuss the problems facing a professor in trying to get a research program started.
4. To propose a joint Program of Action that will help each Participant in his research efforts.

We have tentatively arranged for several lectures by outstanding optical physicists. Typical topics to be covered by the lecturers are:

1. Non-Linear Optics
2. Atmospheric Optics
3. New Fields of Optical Physics
4. Space Optics
5. Radiometry and Photometry
6. Optical Materials
7. Air Glow and Aurora
8. Atomic Spectroscopy
9. Fluorescence and Luminescence
10. Scintillation and Seeing
11. Fiber Optics
12. Metrology
13. Sources and Detectors
14. Thin Films
15. Interferometry - Infrared
16. Lasers
17. Polarization
18. Magneto-Optics
19. Astronomical Observations from Balloons.
20. Research Ideas in Optical Pyrometry

Each of the lecturers has been asked to emphasize in his lecture some unsolved problems that would be suitable as either research or honors projects. Also, each lecturer has been asked to provide copies of his lecture to the Participants.

In addition to the topics listed above, the following supporting aspects of research programs will also be discussed:

a. Use of Experts as Consultants to Small Department Projects
b. Procedures for Obtaining Research Grants
c. Government Surplus Optical Equipment
d. Education and Curriculum for Teacher and Student
e. Summer Employment for Teacher and Student

We are also planning to have a Laser Demonstration of various optical phenomena. Those of us who have seen this Demonstration agree that it has considerable pedagogical value.

The Optical Society is seeking funds for this Conference from the National Science Foundation. These funds are based on an average reimbursement of Participant Expenses for the five days of meeting at $175 for travel, room, and board. Provisions have been made for Participants to be housed and fed on campus. Travel expenses will vary for each Participant and it is intended to distribute travel reimbursement in some proportion to actual need.

Active participation will be required of those attending the Conference. In addition to attending the lectures, each Participant will be expected to take an active part in the group discussions designed to come to grips with the problems a professor faces in beginning a research program and to help in formulating a joint Program of Action.

In order to ensure participation and maximum benefit, the attendees will be assigned to one or two of the eight DISCUSSION GROUP AREAS (I-V and A-C) shown on the attached sheet. The enclosed APPLICATION FORM requests that you designate the GROUPS in which you wish to participate. Every effort will be made to observe your preference but it may be necessary to make changes in order to have balanced GROUPS.

The group members and a Chairman for each GROUP will be designated before the Conference. The Chairman will organize his GROUP'S effort prior to the meeting, make assignments of sub-items to his membership, arrange to meet in the afternoon sessions with particular speakers, etc. The Group Chairmen will report the findings and programs for future action that have been developed during the week. The execution of this Program of Action will constitute the next phase of Task IV. This Action Program will be written for publication in a Society journal.

Task IV now needs to determine how many of those expressing an interest in starting either a research or an honors program in Optical Physics will be able to attend the Conference. It will be greatly appreciated if you will fill out and return the enclosed APPLICATION FORM by March 23. You will be informed by April 15, 1964 as to whether or not your APPLICATION has been accepted, your GROUP assignment, and the status of the Conference.

Yours very truly,

J. H. Taylor

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Enclosures: 1. Group Discussion Areas
2. Application Form

Attachment "G"

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

Southwestern College
Memphis, Tennessee
June 8-12

DISCUSSION GROUP AREAS

Research Projects

GROUP I -	Coherence Effects Lasers Non-Linear Optics Magneto-Optics
GROUP II -	Spectroscopy-Atomic, Molecular, Solid State Interferometry Fluorescence and Luminescence
GROUP III -	Radiometry and Photometry Sources and Detectors Far Ultraviolet and Infrared
GROUP IV -	Atmospheric and Space Optics Astronomy Metrology and Space Surveillance Aurora and Air Glow
GROUP V -	Optical Materials Thin Films Fiber Optics Optical Constants Polarization Geometrical Optics

Supporting Aspects of Research

Personnel Aspects

GROUP A -	Available time for research Consultant aid from field experts Summer employment in optical industry for Professor, Student

Material Support

GROUP B -	Financial support Equipment - surplus and other Reference materials

Education and Curriculum

GROUP C -	Teachers Students

Attachment "H"

OPTICAL SOCIETY OF AMERICA

Application for Attendance at

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

Sponsored by OSA, Optics - An Action Program, Task IV:

Undergraduate Research Programs

To be held at Southwestern College, Memphis, Tennessee

June 8 - 12, 1964

Full Name (print) ______________________________

Present Professional Position ______________________________

Business Address ______________________________

____

I do _____, do not _____, wish to attend Conference.

Designate 3 of the Groups I-V in order of your participation preference

____

____

____

Designate 2 of the Groups A-C in order of your participation preference

____

____

Have you any suggestions or comments concerning the Conference?

____

____

____

______________, 19____. ______________________________
(Date) (Signature of Applicant)

RETURN BY: March 23, 1964
TO: Optical Society of America
1155 Sixteenth Street, n.w.
Washington, D. C. 20036

Attention: J. H. Taylor

Attachment "I"

POST CARD

This is to acknowledge my acceptance of the conditions for participating in the June 8-12 Conference on Undergraduate Research Programs in Optical Physics. ☐

I shall be unable to attent the Conference. ☐

Signed ______________________________

College or University ______________________________

Address ______________________________

This post card should be returned immediately.

OPTICAL SOCIETY of AMERICA

I am glad to be able to tell you that the National Science Foundation has approved the proposal submitted by the Optical Society of America for its Conference on Undergraduate Research Programs in Optical Physics to be held at Southwestern from June 8-12. Your Application for attending this Conference has been approved.

The average allowance per Participant will be $175. This will be figured at $40 for room (beginning Sunday evening, June 7, and extending until Friday evening, June 12) and board (beginning with breakfast on Monday, June 8, and including dinner on Friday, June 12), which will be available on the campus, and $135 for travel. It is the hope to be able to pay equivalent air-tourist fare from the Participant's home site to Memphis. Obviously, those coming from distant points will have an expense greater than the average of $135. We can contribute to this additional expense only to the extent that those coming from the nearer points are less than $135. A check will be issued to you during the Conference.

During the course of the week of June 8-12 there will be 25 lectures. Each Participant will have an opportunity to hear all the lectures.

As stated in my letter of February 19, 1964, the primary purposes of the Conference are the following:

1. To provide the Participants with ideas suitable for both research and honors projects.
2. To bring the Participants up to date on activities in modern Optical Physics.
3. To discuss the problems facing a professor in trying to get a research program started.

4. To propose a joint Program of Action that will help each Participant in his research efforts.

Each Participant is to attend every invited lecture. In addition, he is not only expected to take an active part in the Group Discussions, but he is also expected, with his Chairman and Vice Chairman, to evolve a program in his area which will require a continued action after the Conference.

On the Application form which you recently sent in you were asked to express your preference for Discussion Group Areas. These Discussion Groups were broken down into Research Projects and Supporting Aspects of Research. Under this initial plan each Participant was to have been a member of two different Discussion Groups. Since receiving your Application, Dr. Van Zandt Williams, Director of "Optics - An Action Program" has suggested that it will be easier, from an organizational standpoint, to assign each Participant to only one Discussion Group. We have attempted to assign you to your first choice of either Groups I - V or A - C. Due to the fact that there was a great disparity in the preferences and to our desire to have each of the Groups somewhat evenly divided, this has not always been possible.

You have been assigned to Discussion Group _____ . Each Discussion Group has a Chairman and a Vice Chairman. The Chairman of your Group is Professor _________________________ and the Vice Chairman is Professor ___________. A list of the Group Chairmen and Group Vice Chairmen is enclosed as well as a List of the Discussion Group Areas.

The recommendations and final report of each Discussion Group will be made available to all Participants, regardless of the Discussion Group to which they have been assigned.

During the course of the Conference your Discussion Group Chairman will schedule various times for the members of his Group to meet and discuss. Lectures have been provided that will cover at least some of the items of interest to each Group. It is the responsibility of your Discussion Group Chairman to schedule additional meetings with those Invited Lecturers whose topics pertain to his Group. I am sure that if you have any suggestions or recommendations concerning the material under your Discussion Group that your Chairman would be most happy to receive them. Also, if you should have any ideas or suggestions outside your specific assigned area, please communicate them to the appropriate Group Chairmen.

I would be most appreciative if you would fill out and return the enclosed postcard indicating your final acceptance of the conditions for participating in the Conference. It will be permissible to check in anytime on Sunday, June 7. I am enclosing a map of the campus for your convenience. If you will report to the Haliburton Tower when you arrive on the campus, we will have you officially checked in and will then show you to your quarters.

If you should have any additional questions concerning the Conference do not hesitate to get in touch with me. In closing let me take this opportunity to express my appreciation of your interest in this Conference and to say that we look forward to seeing you at the Conference.

Yours very truly,

J.H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Enclosures:

Map of Campus
Return Postcard
Discussion Group Areas
Conference Invited Lecturers
List of Group Chairmen and Group Vice Chairmen

Attachment "K"

May 23, 1964

Please excuse my long delay in replying to your application to attend the Conference on Undergraduate Research Programs in Optical Physics.

The interest in Task IV of "Optics - An Action Program" has been much greater than we had anticipated. There are 106 college and university teachers who submitted an application to attend the Conference. Although the National Science Foundation approved the proposal submitted by the Optical Society of America for the Conference there are not sufficient funds available to permit all to attend.

I regret very much to tell you that due to lack of funds Task IV is unable to offer you any expense money to attend the Conference. If, however, you are able to cover your own expenses we would certainly welcome your attendance at the Conference.

Yours very truly,

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Attachment "L"

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

OFFICIAL PARTICIPANT ATTENDANCE LIST

Group I - Lasers, Non-Linear Optics,
Magneto-Optics, Coherence Effects

BLOCH, S. C. - Chairman
University of South Florida
Tampa, Florida

MARTIN, ROBERT L. - Vice-Chairman
Lewis and Clark College
Portland, Oregon

EASLEY, HOMER EUGENE
Instructor
Aurora College
Aurora, Illinois

SPURR, ROBERT LYON
Instructor
Emmanuel College
400 The Fenway
Boston 15, Massachusetts

ROBINSON, EDWARD L.
Head
Howard College
Birmingham, Alabama

SMITH, ALBERT E.
Professor
Atlantic Union College
South Lancaster, Massachusetts

LAWLEY, RAYMOND
Professor and Chairman
University of Hartford
36 Sequassen Street
Hartford, Connecticut

COOK, EDWIN OSWALD
Professor and Head
Frostburg State College
Frostburg, Maryland

ZEPF, THOMAS H.
Asst. Professor
Acting Chairman
The Creighton University
Omaha, Nebraska

THERESE, SISTER MARY B.V.M.
Professor and Chairman
Mundelein College
6363 Sheridan Road
Chicago, Illinois

BAINTER, MONICA E.
Professor and Chairman
Wisconsin State College
Stevens Point, Wisconsin

AZBELL, WILLIAM
Head
Wartburg College
Waverly, Iowa

PETZ, JOHN IGNATIUS
Assistant Professor
Little Rock University
Little Rock, Arkansas

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

OFFICIAL PARTICIPANT ATTENDANCE LIST

Group II - Spectroscopy - Atomic, Molecular, Solid State Interferometry, Fluorescence and Luminescence

SNYDER, D.D. - Chairman
Andrews University
Berrier Springs, Michigan

PARKE, EDWARD C., JR. - Vice-Chairman
Humboldt State College
Arcata, California

SCHAULS, SISTER M. ROSWITHA
Chairman
College of Saint Teresa
Winona, Minnesota

CONKLIN, RICHARD LOUIS
Professor
Hanover College
Hanover, Indiana

PERSYN, GILBERT A.
Assistant Professor
St. Mary's University
2700 Cincinnati Avenue
San Antonio, Texas

ANDERSON, WALLACE E.
Professor and Head
The Citadel
Charleston, S. C.

WOOD, JOHN K.
Professor
Utah State University
Logan, Utah

MUNDY, WILLIAM CHARLES
Instructor
Southern Missionary College
Box 361
Collegedale, Tennessee

YOUNGNER, PHILIP G.
Chairman
State College
St. Cloud, Minnesota

BELSKI, ANTHONY JAMES
Instructor
Central State College
Edmond, Oklahoma

BRIEKSI, PHILLIP RICHARD
Assoc. Professor
Chairman
Barstwo Hall of Science
Wisconsin State College
Superior, Wisconsin

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

OFFICIAL PARTICIPANT ATTENDANCE LIST

Group III - Radiometry and Photometry
Sources and Detectors
Far Ultraviolet and Infrared

MARTIN, D. C. - Chairman
Marshall University
Huntington, W. Virginia

RIGGS, JAMES W. - Vice-Chairman
La Sierra College
La Sierra, California

ANTONAKOS, ANTONIOS
Professor
Chairman
Catawba College
Salisbury, N. C.

LAWSON, HARRY VAUGHAN
Instructor
Tarleton State College
Stephenville, Texas

SULLIVAN, REV. SERAPHIN A., O.F.M.
Assistant Professor
Saint Bonaventure University
St. Bonaventure, New York

KAYLOR, HOYT McCOY
Professor
Birmingham-Southern College
Birmingham, Alabama

MASON, HARRY
Professor
Chairman
Jamestown College
Jamestown, North Dakota

PITTMAN, MELVIN A.
Chairman
College of William and Mary
Williamsburg, Virginia

READ, FLOYD M., JR.
Assistant Professor
East Carolina College
Greenville, North Carolina

VALLEY, LEONARD M.
Assistant Professor
St. John's University
Collegeville, Minnesota

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

OFFICIAL PARTICIPANT ATTENDANCE LIST

Group IV - Atmospheric and Space Optics
Astronomy
Metrology and Space Surveillance
Aurora and Air Glow

STAUFFER, FRITZ - Chairman
Southwestern College
Memphis 12, Tennessee

BARNHARDT, ALLEN - Vice-Chairman
Western Kentucky State
Bowling Green, Kentucky

DWYER, ROBERT JOSEPH
Professor and Chairman
Wagner College
Staten Island, New York

CASH, DAN J.
Instructor
Loras College
Dubuque, Iowa

SCHROEDER, DANIEL JOHN
Assistant Professor
Beloit College
Beloit, Wisconsin

PARNELL, DARRELL RAY
Instructor in Physics and Astronomy
Dept. of Physics and Astronomy
Washburn University of Topeka
Topeka, Kansas

ADAMS, CLIFFORD L.
Professor and Chairman
Old Dominion College
Norfolk, Virginia

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

OFFICIAL PARTICIPANT ATTENDANCE LIST

Group V - Optical Materials, Thin Films, Fiber Optics
Optical Constants, Polarization. Geometrical Optics

HILTON, W. A. - Chairman
William Jewell College
Liberty, Missouri

HOLBROW, CHARLES H. - Vice-Chairman
Haverford College
Haverford, Pennsylvania

WOLFE, OTIS KENLEY, JR.
Associate Professor
Centre College
Danville, Kentucky

SIMMONS, JOSEPH WRIGHT
Assistant Professor
La Salle College
Philadelphia 41, Pennsylvania

CONNOLLY, WALTER CURTIS
Professor and Chairman
Appalachian State Teachers College
Boone, N. C.

MOORE, SISTER JOHN FRANSIS
Head
Mary Manse College
2436 Parkwood Avenue
Toledo, Ohio

VERNON, ROBERT C.
Chairman
Simmons College
Boston 15, Massachusetts

WILLIS, WILLIAM RUSSELL
Professor
Box 70
West Virginia Wesleyan College
Buckhannon, West Virginia

GESSERT, WALTER LOUIS
Associate Professor
Eastern Michigan University
Ypsilanti, Michigan

PERRY, RICHARD LEE
Assistant Professor
University of Pacific
Stockton 4, California

Attachment "M"

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

ATTENDANCE AT THE CONFERENCE (OTHER THAN OFFICIAL PARTICIPANTS AND INVITED LECTURERS)

ROLLAND, W.W.
Dept. of Physics
King College
Bristol, Tennessee

BIRD, ALVIN N., JR.
Southern Research Institute
Birmingham, Alabama

SMITH, H. M.
Institute of Optics
University of Rochester
Rochester, New York
(graduate student)

TUBBS, ELDRED
Dept. of Physics
Harvey Mudd College
Claremont, California

WORLEY, R. E.
Dept. of Physics
University of Nevada
Reno, Nevada

NIELSEN, ALVIN H.
Dept. of Physics
University of Tennessee
Knoxville, Tennessee

GUTTMAN, MARK
Dept. of Physics
La Salle College
Philadelphia, Pennsylvania

GLENN, DAVID
Infrared Group
Cape Kennedy
Patrick Air Force Base, Florida

MacQUEEN, R. M.
Lab. of Astrophysics and
Physical Meteorology
The Johns Hopkins University
Baltimore, Maryland
(graduate student)

DORMAN, E.S.
Dept. of Physics
The Johns Hopkins University
Baltimore, Maryland
(graduate student)

STREETE, J. L.
Dept. of Physics
University of Florida
Gainesville, Florida
(graduate student)

McKINLEY, J. E.
Dept. of Physics
Southwestern College
Memphis, Tennessee

HANSON, H. M.
Dept. of Physics
Southwestern College
Memphis, Tennessee

HACKLEMAN, W. R.
Dept. of Physics
Southwestern College
Memphis, Tennessee

RUFFIN, G. P.
Dept. of Physics
Southwestern College
Memphis, Tennessee

EMERY, A. C.
Dept. of Physics
Southwestern College
Memphis, Tennessee

RHODES, P. N.
President
Southwestern College
Memphis, Tennessee

TAYLOR, J. H.
Dept. of Physics
Southwestern College
Memphis, Tennessee

PRINZ, DIANE K.
Lab. of Astrophysics and
Physical Meteorology
The Johns Hopkins University
Baltimore, Maryland
(graduate student)

HEFFERLIN, R.
Dept. of Physics
Southern Missionary College
Collegedale, Tennessee

WARGA, M. E.
Optical Society of America
Washington, D. C.

WILLIAMS, V. Z.
Director, "Optics - An
Action Program"
Norwalk, Connecticut

LYON, JOHN C.
St. Mary's University
San Antonia, Texas
(undergraduate student)

The following undergraduate physics majors from Southwestern College also attended:

WEHLING, M. F.
Dept. of Physics
Southwestern College
Memphis, Tennessee
(undergraduate student)

ROBERTSON, C. W.
Dept. of Physics
Southwestern College
Memphis, Tennessee
(undergraduate student)

McKNIGHT, J. M.
Dept. of Physics
Southwestern College
Memphis, Tennessee
(undergraduate student)

VAUGHN, R. T., JR.
Dept. of Physics
Southwestern College
Memphis, Tennessee
(undergraduate student)

HOLMES, P. W.
Dept. of Physics
Southwestern College
Memphis, Tennessee
(undergraduate student)

HOFFMAN, SARA W.
Dept. of Physics
Southwestern College
Memphis, Tennessee
(undergraduate student)

Attachment "N"

COLLEGE AND UNIVERSITY PROFESSORS WHO REQUESTED PERMISSION TO ATTEND THE CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

ADAMS, CLIFFORD L.
Professor and Chairman
Old Dominion College
Norfolk 8, Virginia

ANDERSON, WALLACE E.
Professor and Head
Physics Dept.
The Citadel
Charleston, S. C.

ANTONAKOS, ANTONIOS
Professor of Physics
Chairman of Dept.
Catawba College
Salisbury, North Carolina

AZBELL, WILLIAM
Head
Wartburg, College
Waverly, Iowa

BAINTER, MONICA E.
Professor and Chairman
Wisconsin State College
Stevens Point, Wisconsin

BARNHARDT, EDWARD A.
Assistant Professor
College Heights
Bowling Green, Ky.

BELSKI, ANTHONY JAMES
Instructor
Central State College
Edmond, Oklahoma

BISER, ROY H.
Associate Professor
Lamar State College of Technology
Beaumont, Texas

BLACK, HOWARD T.
Associate Professor
Indiana State College
Terre Haute, Indiana

BLOCH, SYLVAN CHARLES
Assistant Professor
Chemistry Bldg.
Room 304G
University of South Florida
Tampa, Florida

BREED, HENRY E.
Associate Professor
Rensselaer Polytechnic Institute
Troy, New York 12181

BRIESKE, PHILLIP RICHARD
Associate Professor
Chairman
Barstwo Hall of Science
Wisconsin State College
Superior, Wisconsin 54881

BROWN, EDWARD B.
Assistant in Physics
Manhattan College
New York 71, N. Y.

CARPENTER, DELMA RAE JR.
Professor
Virginia Military Institute
Lexington, Va.

CASH, DAN J.
Instructor
Loras College
Dubuque, Iowa 52003

CLEMENTS, JOHN HERBERT
Professor and Head
East Texas State College
Connerce, Texas 75429

CLOTTELTER, B. E.
Associate Professor
Grinnell College
Grinnell, Iowa

CONKLIN, RICHARD LOUIS
Professor
Hanover College
Hanover, Indiana

CONNOLLY, JAMES HENRY
Assistant Professor
Acting Chairman
King's College
Wilkes-Barre, Pa.

CONNOLLY, WALTER CURTIS
Chairman and Professor
Appalachain State Teachers College
Boone, N. C.

COOK, EDWIN OSWALD
Professor and Head
Frostburg State College
Frostburg, Maryland

COULLIETTE, JAMES HORACE
Professor and Chairman
University of Miami
Coral Cables, Florida

DAM, CECIL F.
Professor and Chairman
Cornell College
Mount Vernon, Iowa

DWYER, ROBERT JOSEPH
Professor and Chairman
Wagner College
Staten Inland, N. W. 10301

EASLEY, HOMER EUGENE
Instructor
Aurora College
Aurora, Illinois

ELLIOTT, STUART
Assistant Professor
Occidental College
Los Aneles, California 90041

FLETCHER, NEIL
Assistant Professor
Florida State University
Tallahassee, Florida 32306

FOSTER, IRVING GORDON
Chairman, Math-Science Division
Professor
Florida Presbyterian College
St. Petersburg, Florida

FUSON, NELSON
Professor
Fisk University
Nashville 8, Tennessee

GARNER, DR. WILLIAM
Chairman
University of Bridgeport
Bridgeport, Connecticut

GESSERT, WALTER LOUIS
Associate Professor
Eastern Michigan University
Ypsilanti, Michigan 48197

GOBLE, ALFRED THEODORE
Professor
Union College
Schenectady, New York 12308

GUNTER, ROY C. JR.
Associate Professor
Holy Cross College
Worcester, Massachusetts

GUREVITCH, MARK
Professor and Chairman
Portland State College
P. O. Box 751
Portland, Oregon 97207

GUTSCHE, GRAHAM D.
Professor
Science Department
U. S. Naval Academy
Annapolis, Maryland

HAMBY,DRANNAN C.
Assistant Professor
Linfield College
McMinnville, Oregon

HARTMAN, ROGER D.
Assistant Professor
University of Tulsa
Tulsa, Oklahoma 74104

HEAD, VERNON H.
Assistant Professor
Spring Hill College
Mobile, Alabama

HENRY, HUGH F.
Head
DePauw University
Greencastle, Indiana

HILTON WALLACE A.
Professor
Head
William Jewell College
Liberty, Missouri

HINDS, CONRADE CARLYLE
Associate Professor
Box 9291 Southern University
Baton Rouge, La. 70813

HODGES, SIDNEY E.
Head
Box 494 SPA Station
Nacogdoches, Texas
(Stephen F. Austin State College)

HOLBROW, CHARLES H.
Assistant Professor
Haverford College
Haverford, Pennsylvania 19041

HOLMES, JOHN R.
Professor and Chairman
University of Hawaii
Honolulu 14, Hawaii

HOOVER, MARTIN E.
Assistant Professor
Goshen College
Goshen, Indiana

HULTS, MALCOM EUGENE
Assistant Professor of Science
Chairman, Physics Section
Ball State Teachers College
Muncie, Indiana

KAYLOR, HOYT MCCOY
Professor
Birmingham-Southern College
Birmingham, Alabama 35204

KECK, WINFIELD
Professor and Chairman
Lafayette College
Easton, Pa.

KING, ALLEN LEWIS
Professor
(I Teach Optics)
Dartmouth College
Hanover, New Hampshire

KOVACH, LADIS D.
Head
Department of Mathematics and Physics
Pepperdine College
W. 79th Street at Vermont Avenue
Los Angeles, California 90044

LAWLEY, RAYMOND
Professor and Chairman
University of Hartford
36 Sequassen Street
Hartford, Conn.

LAWSON, HARRY VAUGHAN
Instructor of Physics
Tarleton State College
Stephenville, Texas

LONG, ROBERT II
Instructor
Worcester Polytechnic Institute
Worcester, Mass.

MARTIN, DONALD, C.
Chairman
Marchall University
Huntington, W. Va. 25701

MARTIN, JAMES MERRILL
Associate Professor
University of Wisconsin-Milwaukee
Milwaukee, Wisconsin 53211

MARTIN, ROBERT L.
Associate Professor
Chairman
Lewis and Clark College
Portland, Oregon

MASON, HARRY
Professor
Chairman
Jamestown College
Jamestown, North Dakota

MITCHELL, H. REES
Professor
Michigan Tech. University
Houghton, Michigan 49931

MOORE, SISTER JOHN FRANSIS
Head
Mary Manse College
2436 Parkwood Avenue
Toledo, Ohio 43620

MUNDY, WILLIAM CHARLES
Instructor in Physics
Southern Missionary College
Box 361
Collegedale, Tennessee

MURTAUGH, REV. WALTER A. O. P.
Chairman
Providence College
Providence 8, R. I. 02908

NIELSEN, ALVIN H.
Head, Department of Physics
University of Tennessee
Knoxville, Tennessee

NORRIS, DR. WILFRED G.
Chairman
Juniata College
Huntington, Pennsylvania

PARKE, EDWARD CHARLES JR.
Associate Professor
Humboldt State College
Arcata, California

PARNELL, DARRELL RAY
Instructor in Physics and Astronomy
Dept. of Physics & Astronomy
Washburn University of Topeka
Topeka, Kansas

PECKHAM, DONALD C.
Associate Professor
St. Lawrence University
Canton, New York 13617

PERRY, RICHARD LEE
Assistant Professor
University of Pacific
Stockton 4, California

PERSYN, Dr. Gilbert A.
Assistant Professor
St. Mary's University
2700 Cincinnati Avenue
San Antonio, Texas 78228

PETRIK, EUGENE V.
Associate Professor
Head of Department
Seton Hall University
South Orange, New Jersey

PETZ, JOHN IGNATIUS
Assistant Professor
Little Rock University
Little Rock, Arkansas

Pittman, Melvin A.
Chairman
College of William & Mary
Williamsburg, Virginia

PRATHER, JOHN LYLE
Professor
Pennsylvania Military College
Chester, Pa. 19013

PROCTOR, DAVID G.
Chairman; Associate Professor
Baldwin Wallace College
Berea, Ohio 44017

READ, FLOYD M. JR.
Department of Physics
Assistant Professor
East Carolina College
Greenville, N. C. 27834

RHODES, JACOB L.
Associate Professor
Chairman
Lebanon Valley College
Annville, Pa. 17003

RIGGS, JAMES WILLBORN JR.
Professor and Head
La Sierra College
La Sierra, California 92505

ROBINSON, DR. EDWARD L.
Head
Howard College
Birmingham, Alabama 35209

Ross, John Stoner
Professor
Chairman
Rollins College
Winter Park, Florida

Schauls, Sister M. Roswitha
Chairman
College of Saint Teresa
Winona, Minnesota 55987

SCHROEDER, DNAIEL JOHN
Assistant Professor
Beloit College
Beloit, Wisconsin 53512

SCHWETMAN, HERBERT D.
Chairman
Dept. of Physics
Baylor University
Waco, Texas

SIMMONS, JOSEPH WRIGHT
Assistant Professor
La Salle College
Philadelphia 41, Pa.

SMITH, ALBERT E.
Professor of Physics
Atlantic Union College
So. Lancaster, Mass.

SNYDER, DONALD D.
Chairman
Andrews University
Berrien Springs, Michigan 49104

SPELL, WILLIAM HOWARD
Associate Professor
Belhaven College
Jackson, Mississippi 39202

SPURR, ROBERT LYON
Instructor
Emmanuel College
400 The Fenway
Boston 15, Mass.

STAUFFER. FRITZ.
Assistant Professor
Southwestern at Memphis
Memphis 12, Tennessee

STEPHENSON, HAROLD PATTY
Professor
Pfeiffer College
Misenheimer, N. C. 28109

SULLIVAN, SERAPHIN ANTHONY (REV.)
Assistant Professor
Saint Bonaventure University
St. Bonaventure, New York 14778

SWAMINATHA SUNDARAM
Associate Professor
Associate Director Spectroscopy Lab.
Illinois Institute of Technology
Chicago, Illinois 60616

TAYLOR, JACK HOWARD
Professor and Chairman
Southwestern College
2000 North Parkway
Memphis 12, Tennessee

THERESE, SISTER MARY B.V.M.
Professor and Chairman
Mundelein College
6363 Sheridan Rd.
Chicago, Illinois 60626

TUBBS, ELDRED F.
Assistant Professor
Harvey Mudd College
Claremont, California 91716

VALLEY LEONARD M.
Assistant Professor
St. John's University
Collegeville, Minnesota

VEHSE, WILLIAM EVERETT
Assistant Professor
West Virginia University
Morgantown, W. Va. 26506

VERNON, ROBERT C.
Chairman
Simmons College
Boston 15, Mass.

WIEGAND, ROY V.
Professor
Montana State College
Bozeman, Montana

WILLIAMS, GEORGE P. JR.
Associate Professor
Box 7441 R. S.
Wake Forest College
Winston-Salem, N. C.

WILLIA, WILLIAM RUSSELL
Professor
Box 70
West Va. Wesleyan College
Buckhannon, West Va.

WILSON, RAYMOND G.
Acting Head
Illinois Wesleyan University
Bloomington, Illinois 61701

WOLFE, OTIS KENLEY JR.
Associate Professor of Physics
Department of Physics
Centre College
Danville, Kentucky

WOLLETT, ALBERT HAINES
Assistant Professor
Memphis State University
Memphis, Tennessee 38111
Box 768, M.S.U.

WOOD, JOHN K.
Professor
Utah State University
Logan, Utah

WORLEY, R. EDWIN
Professor (& acting Chairman)
University of Nevada
Reno, Nevada

YOUNGMAN, LESTER A.
Division Director
Pan American College
Edinburg, Texas

YOUNGNER, DR. PHILIP G.
Chairman
State College
St. Cloud, Minnesota

ZEPF, DR. THOMAS H.
Assistant Professor
Acting Chairman
The Creighton University
Omaha, Nebraska 68131

Attachment "O"

OPTICAL SOCIETY of AMERICA

The purpose of this letter is to inform you that you have been chosen to serve as Chairman of Discussion Group_____during the Conference on Undergraduate Research Programs in Optical Physics. It was the feeling of the group that chose you that you could make a definite contribution to the Conference in this capacity.

As a Group Chairman you will have the following responsibilities:

(1) Introduce those Invited Lecturers whose lecture falls within the scope of interest of your Group.

(2) Organize your Group's effort prior to the Conference.

(3) Make assignments of Sub-items to members of your Group.

(4) Arrange for particular Invited Lecturers to meet with you and your group during the Conference.

(5) Assemble the other members of your Group at various times throughout the five day period of the Conference for a discussion of the various topics listed for your Group.

(6) On Friday (June 12) make a verbal report to the assembled Conference Participants of the findings and program for future action that has developed in your Group during the week.

A copy of the Group Discussion Areas is enclosed for your convenience. It may well be that in your discussions other areas will come up and you will want to pursue them. Definite periods during the Conference have been set aside for Group discussions. These Group discussions are not to be scheduled during the time at which any of the twenty-five invited lectures are being given.

As you know, the Conference Participants will be divided into eight Discussion Groups of approximately the same size. Each Discussion Group will have a Chairman and a Vice Chairman. The Chairmen and Vice Chairmen will play a very important part during this Conference. As Group leaders they will have the responsibility of making a final report to the Conference Participants on the last day of the Conference summarizing the results of their Group's discussions during the week. It is the hope that out of the final reports of these various Discussion Groups there will emerge a Program of Action. In this connection you should not consider the forthcoming Conference as the final phase of Task IV. It might very well be only the beginning. The report to the assembled Conference Participants which is to be provided verbally on Friday (June 12) is to be made available in writing within 3 - 4 weeks after the Conference. It is hoped that each Group can generate a program which can be followed in the future with a periodic report.

In closing let me congratulate you on your opportunity to serve as one of the Group Chairmen.

Sincerely yours,

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Enclosures:

Conference Invited Lecturers
Letter to Corporation Members of the Optical Society of America
Discussion Group Areas
Group_____Participants

Attachment "P"

OPTICAL SOCIETY *of* AMERICA

The purpose of this letter is to inform you that you have been chosen to serve as Vice Chairman of Discussion Group _____ during the Conference on Undergraduate Research Programs in Optical Physics. It was the feeling of the group that chose you that you could make a definite contribution to the Conference in this capacity.

As a Group Vice Chairman you will assist your Group Chairman in the following responsibilities:

(1) Introduce those Invited Lecturers whose lecture falls within the scope of interest of your Group.

(2) Organize your Group's effort prior to the Conference.

(3) Make assignments of Sub-items to members of your Group.

(4) Arrange for particular Invited Lecturers to meet with you and your Group during the Conference.

(5) Assemble the other members of your Group at various times throughout the five day period of the Conference for a discussion of the various topics listed for your Group.

(6) On Friday (June 12) make a verbal report to the assembled Conference Participants of the findings and program for future action that has developed in your Group during the week.

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As you know, the Conference Participants will be divided into eight Discussion Groups of approximately the same size. Each Discussion Group will have a Chairman and a Vice Chairman. The Chairmen and Vice Chairmen will play a very important part during this Conference. As Group leaders they will have the responsibility of making a final report to the Conference Participants on the last day of the Conference summarizing the results of their Group's discussions during the week. It is the hope that out of the final reports of these various Discussion Groups there will emerge a Program of Action. In this connection you should not consider the forthcoming Conference as the final phase of Task IV. It might very well be only the beginning. The report to the assembled Conference Participants which is to be provided verbally on Friday (June 12) is to be made available in writing within 3-4 weeks after the Conference. It is hoped that each Group can generate a program which can be followed in the future with a periodic report.

In closing let me congratulate you on your opportunity to serve as one of the Group Vice Chairmen.

Sincerely yours,

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Enclosures:

Conference Invited Lecturers
Letter to Corporation Members of the Optical Society of America
Discussion Group Areas
Group _____ Participants

Attachment "Q"

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

Southwestern College
Memphis, Tennessee
June 8-12

Name	Chairman of Group	College or University	Address
S. C. Bloch	Group I	University of South Florida	Tampa, Florida
D. D. Snyder	Group II	Andrews University	Berrier Springs, Michigan
D. C. Martin	Group III	Marshall University	Huntington, West Virginia
Fritz Stauffer	Group IV	Southwestern	Memphis 12, Tennessee
W. A. Hilton	Group V	William Jewell College	Liberty, Missouri
D. G. Proctor	Group A	Baldwin Wallaca College	Berea, Ohio
Rev. W. A. Murtaugh	Group B	Providence College	Providence 8, Rhode Island
S. B. Elliott	Group C	Occidental College	Los Angeles, California

Name	Vice Chairman of Group	College or University	Address
Robert L. Martin	Group I	Lewis & Clark College	Portland, Oregon
Edward C. Parke, Jr.	Group II	Humboldt State College	Arcata, California
James W. Riggs	Group III	La Sierra College	La Sierra, California
Allen Barnhardt	Group IV	Western Ky. State	Bowling Green, Kentucky
Charles H. Holbrow	Group V	Haverford College	Haverford, Penn.
L. A. Youngman	Group A	Pan American College	Edinburg, Texas
Donald C. Peckham	Group B	The St. Lawrence Univ.	Canton, New York
Raymond G. Wilson	Group C	Illinois Wesleyan Univ.	Bloomington, Illinois

7

Attachment "R"

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

Southwestern College
Memphis, Tennessee

June 8-12

INVITED LECTURERS

Name	Address	Lecture
Roderic M. Scott	Electro-Optical Division The Perkin-Elmer Corporation Norwalk, Connecticut	Space Optics
Harold S. Stewart	E. H. Plesset Associates, Inc. 2444 Wilshire Boulevard Santa Monica, California	Scintillation and Seeing
F. S. Johnson	Atmospheric and Space Sciences Division Southwest Center for Advanced Studies - Dallas, Texas	Airglow and Aurora
Gordon Newkirk, Jr.	High Altitude Observatory Boulder, Colorado	Balloon Astronomy
John A. Sanderson	Optics Division U. S. Naval Research Laboratory Washington 25, D. C.	Radiometry and Photometry
Lloyd G. Mundie	Lockheed Aircraft Corporation California Division Burbank, California	Sources and Detectors
H. J. Kostkowski	High Temperature Measurement Laboratory - Heat Division National Bureau of Standards Washington 25, D. C.	Research Ideas in Optical Pyrometry
John N. Howard	Air Force Cambridge Research Laboratories Bedford, Massachusetts	Defense Department Interests in Optical Physics
R. W. Terhune	Scientific Laboratory Ford Motor Company Dearborn, Michigan	Non-Linear Optics
George B. Wright	Lincoln Laboratory Massachusetts Institute of Technology	Magneto-Optics

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

INVITED LECTURERS

Name	Address	Lecture
Edward N. Adams	International Business Machines Corporation Thomas J. Watson Research Center Yorktown Heights, New York	Optical Character Recognition
R. M. Blakney	Institute of Optics University of Rochester Rochester, New York	Laser Demonstration
John D. Strong	The Johns Hopkins University Baltimore, Maryland	Interferometry
Karl Kessler	Atomic Physics Laboratory National Bureau of Standards Washington 25, D. C.	Spectroscopy
Albert K. Levine	General Telephone and Electronics Laboratories, Inc. Bayside Laboratories Bayside, New York	Fluorescence and Luminescence
D. H. Rank	The Pennsylvania State University University Park, Penn.	Adventures in Infrare Spectroscopy
N. S. Kapany	Optics Technology, Inc. 248 Harbor Boulevard Belmont, California	Fiber Optics
Lawrence N. Hadley	Colorado State University Fort Collins, Colorado	Thin Films
William Wolfe	Institute of Science and Technology The University of Michigan Ann Arbor, Michigan	Optical Materials
Clinton W. Kersey	Personal Property Branch Dept. of Health, Education and Welfare Washington, D. C.	Government Surplus Property

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

INVITED LECTURERS

Name	Address	Lecture
William N. Ellis	Physics Section National Science Foundation Washington 25, D. C.	Other Aspects of Federal Support for Scientific Research
Myron A. Jeppesen	National Science Foundation Washington, D. C. 20550 Bowdoin College Brunswick, Maine	The Place of Optics in Proposed Physics Curricula
William Wolfe	Institute of Science and Technology The University of Michigan Ann Arbor, Michigan	Optics in an Engineering Curriculum
Henry E. Breed	Rensselaer Polytechnic Institute Rowland Laboratory Troy, New York	Proposed Undergraduate Course in Optical Physics
Lewis Bodi	General Telephone and Electronics Laboratories, Inc. Bayside Laboratories Bayside, New York	Fluorescence Demonstration
Leonard Eisner	Barnes Engineering Company Stanford, Connecticut	Demonstration of the Barnes Educational Spectrometer ES100

Attachment "S"

OPTICAL SOCIETY *of* AMERICA

I am glad to be able to tell you that the National Science Foundation has approved the proposal submitted by the Optical Society of America for its Conference on Undergraduate Research Programs in Optical Physics to be held at Southwestern from June 8 - 12.

Task IV will reimburse you for travel expenses incurred in attending the Conference. Room and board will be available on the campus and we shall reimburse you for the cost of your round trip tourist air fare.

We are looking forward to your lecture on

____

which is scheduled for_______________ June_________. As you know, the primary purpose of this Conference is to provide college and university teachers, particularly at the undergraduate level, with ideas for either research honors projects, or both, in the field of Optical Physics. It will be greatly appreciated if you will send me either a copy of your lecture, or at least an outline, in sufficient time to have it copied and distributed to the Conference Participants. Your assistance in this matter will be greatly appreciated.

The Conference Participants will be assigned to one of eight Discussion Groups. Each Group will have a Chairman and Vice-Chairman. We are trying to be most serious in their responsibilities. It is quite likely that one or more of them will be in correspondence with you before the Conference. During the Conference some of them will be asking you to meet with their respective Groups.

If the above listed date for your lecture is inconvenient I would appreciate your letting me know as soon as possible. There are twenty-five Invited Lecturers to the Conference and we shall do our best to try to pick a time most suitable for each.

In closing let me take this opportunity to thank you for having agreed to lecture to the Conference. If you will let me know when you plan to arrive in Memphis I shall have someone meet you at tha airport and bring you to Southwestern.

Sincerely yours,

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Enclosures:

Letter to Participants
Letter to Group Chairmen
Letter to Corporation Members of the Optical Society of America
Conference Invited Lecturers
Discussion Groups

Attachment "T"

OPTICAL SOCIETY *of* AMERICA

Dear Sirs:

The purposes of this letter are twofold, namely, to bring you up to date on Task IV of "Optics - An Action Program" and to ask your assistance in connection with this Task.

"Optics - An Action Program" is the program of corrective action that was proposed by the Needs in Optics Committee. This committee was under the Chairmanship of V. Z. Williams. This action program was broken up into six different Tasks. Dr. Williams asked me to assume leadership of Task IV which concerns itself with Undergraduate Research Programs.

Task IV has now progressed to the point where it is having a Conference on Undergraduate Research Programs in Optical Physics at Southwestern College (Memphis, Tennessee) from June 8-12. The Optical Society of America submitted a proposal for this Conference to the National Science Foundation which has been approved.

The primary purposes of the Conference are the following:

1. To provide the Participants with ideas suitable for both research and honors projects.
2. To bring the Participants up to date on activities in modern Optical Physics.
3. To discuss the problems facing a professor in trying to get a research program started.
4. To propose a joint Program of Action that will help each Participant in his research efforts.

There are 106 college and university teachers wanting to attend the Conference. Present funds will permit only about 75 to attend, however.

Twenty-five invited lecturers will address the Conference during the five day period. In addition, there will be Group Discussions among the participants each day.

The second purpose of this letter, alluded to in the first paragraph, is to inquire whether or not your company has any educational or pedagogical literature in the general field of Optical Physics that it would be willing to send to the Conference for distribution to the Participants. If you have material of scientific value to this Conference, I would be most appreciative if you would send me 100 copies at your earliest convenience. I can then inform the Group Chairman that such material is available.

Yours very truly,

J. H. Taylor, Leader OSA Task IV
Professor of Physics and Chairman
Department of Physics
Southwestern College
Memphis, Tennessee

Enclosures:

- Letter to Participants
- Letter to Group Chairmen
- Conference Invited Lecturers

Attachment "U"

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

PROGRAM

MONDAY

This Session was chaired by F. R. Stauffer (Southwestern College, Memphis, Tennessee)

TIME	LECTURER	LECTURE
8:15 - 9:15	P. N. Rhodes (President, Southwestern College)	Welcome
	Van Zandt Williams J. H. Taylor	Keynote Address
9:30 - 10:30	R. M. Scott	Space Optics
Coffee Break		
10:45 - 11:45	Group Meetings	
12:00 - 1:00	Lunch	
1:30 - 2:30	H. S. Stewart	Scintillation and Seeing
Coffee Break		
3:00 - 4:00	G. Newkirk	Balloon Astronomy
4:15 - 5:15	C. W. Kersey	Surplus Property (Health, Education and Welfare Dept.)
5:30 - 6:30	Group Meetings	
6:30 - 7:30	Dinner	
7:30 - 8:30	G. Newkirk	Film on Coronascope II

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

PROGRAM

TUESDAY

This Session was chaired by W. A. Hilton (William Jewell College, Liberty, Missouri)

TIME	LECTURER	LECTURE
8:15 - 9:15	J. A. Sanderson	Radiometry and Photometry
9:30 - 10:30	N. S. Kapany	Fiber Optics
Coffee Break		
10:45 - 11:45	H. J. Kostkowski	Research Ideas in Optical Pyrometry
12:00 - 1:00	Lunch	
1:30 - 2:30	L. Mundie	Sources and Detectors
Coffee Break		
3:00 - 4:00	W. Ellis	Aspects of Federal Support for Scientific Research
4:15 - 5:15	A. K. Levine	Lasers
5:30 - 6:30	J. N. Howard	Defense Department Interest in Optical Physics
6:30 - 7:30	Dinner	
7:30 - 8:30	A. K. Levine L. Bodi	Fluorescence Demonstration
8:30 - 9:30	L. Eisner	Demonstration of the Barnes Educational Spectrometer ES100

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

PROGRAM

WEDNESDAY

This Session was chaired through 2:30 P.M. by S. C. Block (University of South Florida, Tampa, Florida). The Session was chaired after 2:30 P.M. by S. B. Elliott (Occidental College, Los Angeles, California).

TIME	LECTURER	LECTURE
8:15 - 9:15	R. W. Terhune	Non-Linear Optics
9:30 - 10:30	G. B. Wright	Magneto Optics
Coffee Break		
10:45 - 11:45	W. Wolfe	Optical Materials
12:00 - 1:00	Lunch	
1:30 - 2:30	F. S. Johnson	Airglow and Aurora
Coffee Break		
3:00 - 4:00	M. A. Jeppesen	The Place of Optics in Proposed Physics Curricula
4:15 - 5:15	W. Wolfe	Optics in an Engineering Curriculum
5:30 - 6:30	H. Breed	Proposed Undergraduate Course in Optical Physics
6:30 - 7:30	Dinner	
7:30 - 8:30	R. Blakney	Laser Demonstration

Note: After Dr. Blakney's demonstration open house for the Participants was held at the home of Dr. and Mrs. Rhodes

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

PROGRAM

THURSDAY

This Session was chaired by D. D. Snyder (Andrews University, Berrier Springs, Michigan).

TIME	LECTURER	LECTURE
8:15 - 9:15	J. D. Strong	Interferometry
9:30 - 10:30	K. Kessler	Spectroscopy
Coffee Break		
10:45 - 11:45	L. N. Hadley	Thin Films
12:00 - 1:00	Lunch	
1:30 - 2:30	D. H. Rank	Adventures in Infrared Spectroscopy
Coffee Break		
3:00 - 4:00	E. N. Adams	Optical Character Recognition
6:30 - 7:30	Dinner	

Note: After Dr. Adams' lecture the Groups went into meeting. The Groups had until midnight to turn in their Group Reports.

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

PROGRAM

FRIDAY

This Session was chaired by D. G. Proctor (Baldwin Wallace College, Berea, Ohio).

TIME	LECTURER	LECTURE
8:15 - 9:15	Group I Group II Group III	Reports
9:30 - 10:30	Group IV Group V	Reports
Coffee Break		
10:45 - 11:45	Group A Group B Group C	Reports
12:00 - 1:00	Lunch	
6:30 - 7:30	Dinner	

Note: (1) At the end of the morning coffee break, President Rhodes introduced Mr. Alfred Kelleher and Dr. Marcey of the Research Corporation to the Conference Participants. Mr. Kelleher spoke for a few minutes on the purpose of the Research Corporation.

(2) During the afternoon Mr. Kelleher made himself available to speak to several of the Participants who were interested in seeking financial assistance from the Research Corporation.

(3) The Southwestern Physics Department was open for inspection during the afternoon. Most of the Participants visited the laboratories during this time. Also, there was on display for them most of the commercially available microwave apparatus for use in teaching optical physics. It shouls be pointed out that Dr. W. Kelly of the A.I.P. had requested the physics department to evaluate this microwave equipment and he had requested the various manufacturers to make certain that their apparatus arrived in time for the Conference.

Attachment "V"

NEWS FROM **THE AMERICAN INSTITUTE OF PHYSICS**
335 EAST 45 STREET, NEW YORK 17 MURRAY HILL 5-1940

EUGENE H. KONE
Director of Public Relations

RELEASED FOR FRIDAY, JUNE 5, 1964

SCIENTISTS MEETING IN MEMPHIS TO STIMULATE OPTICS RESEARCH AMONG U.S. COLLEGE STUDENTS

New York, June 4--: Several of the nation's most prominent scientists will meet at Southwestern College at Memphis, Tennessee Monday through Friday June 8-12, to explore methods of stimulating research by college undergraduates in the physics of optics.

They are meeting at the instigation of the Optical Society of America with the support of the National Science Foundation. The purpose of the meeting is to encourage college students to become interested in optics by doing research in the field.

Dr. Van Zandt Williams, Vice President of the Perkin-Elmer Corporation in Norwalk, Connecticut, is chairman of the Society's "Needs in Optics" Committee

Dr. Jack H. Taylor, Professor of Physics of Southwestern at Memphis College is director of the section of the study concerned with undergraduate research programs in optics.

"During the last few years," says a report on optics in America, "there has come a seeming contradiction in the field of optics. Simultaneously, there are indications of a de-emphasis of optics in academic teaching and research together with a tremendous increase in the application of optics with a consequent shortage of

-more-

personnel with training in optics."

The authorities who will speak to approximately 90 college and university professors of physics are from governmental, industrial, and educational institutions.

Five major areas of optics, which can form the basis of research projects by undergraduates, will be discussed in detail. The first grouping concerns coherence effects, lasers, non-linear optics, and magneto-optics. The second is on spectroscopy (atomic, molecular, and solid state, interferometry, and fluorescence and luminescence).

The third area to be discussed includes: radiometry and photometry, sources and detectors; far ultraviolet and infrared.

The fourth area includes: atmospheric and space optics, astronomy, metrology and space surveillance, aurora and air glow.

The fifth area will be concerned with optical materials, thin films, fiber optics, optical constants, polarization, and geometrical optics.

In addition to the research areas, the participants will discuss methods of obtaining governmental and other funds to support research by undergraduates, the relationship of the student to the teacher, and methods of obtaining cooperation between the small liberal arts college and a nearby, cooperating university.

The program will present ideas suitable for both research and honors projects, will bring the participants up to date on activities in modern optical physics, and outline the problems facing a professor who starts a research program for his students.

Each subject of the symposium is assigned to a specific group of participants to generate programs for continuing help to the professors.

Keynote speakers at the opening session of the conference will be: Dr. Peyton N. Rhodes, President of Southwestern College at Memphis; Dr. Williams, and Dr. Taylor.

-more-

Participants on Monday, June 8, will include: Dr. Roderic M. Scott, Vice President of Perkin-Elmer Corporation, Norwalk, Conn.; Dr. Harold S. Stewart, E.H. Plesset Associates, Inc., Santa Monica, Calif.; Dr. G. Newkirk, High Altitude Observatory, Boulder, Colorado; Dr. Clinton W. Kersey, Department of Health, Education and Welfare; and Dr. Knotts Millsap, University of Florida, Gainesville.

Tuesday, June 9th speakers will be: Dr. John A. Sanderson, Naval Research Laboratory Washington, D.C.; Dr. Lloyd G. Mundie, Lockheed Aircraft Corporation, Burbank, Calif.; Dr. H. J. Kostkowski, National Bureau of Standards; Dr. John N. Howard, of the Air Force Cambridge Research Center and Editor of "Applied Optics"; Dr. William N. Ellis, Physics Section, National Science Foundation; and Dr. N.S. Kapany, Optics Technology, Inc., Belmont, Calif.

On Wednesday, June 10, the scientists who will speak are: Dr. R.W. Terhune, Ford Scientific Laboratory; Dr. G.B. Wright, Lincoln Laboratory; Dr. William Wolfe, Institute of Science and Technology, University of Michigan; Dr. F.S. Johnson, Southwest Center for Advanced Studies, Dallas, Texas; Dr. Myron A. Jeppesen, National Science Foundation and Bowdoin College; and Dr. Henry E. Breed, Rensselaer Polytechnic Institute. Dr. R.M. Blaknewy, of the University of Rochester's Institute of Optics, will give an after-dinner talk and demonstration on lasers.

The speakers on Thursday, June 11, will include the following: Dr. John D. Strong, The Johns Hopkins University; Dr. Karl Kessler, Atomic Physics Laboratory, National Bureau of Standards; Dr. Albert K. Levine, General Telephone and Electronics Laboratories, Inc., Bayside, New York; Dr. D.H. Rank, The

-more-

Pennsylvania State University; Dr. E.N. Adams, International Business Machines Thomas J. Watson Research Center, Yorktown, N.Y.; Dr. Lawrence N. Hadley, Colorado State University, Fort Collins, Colorado; and Dr. Shirleigh Silverman, Office of Naval Research, Washington, D.C.

The Friday meeting will be concerned with reports of the various group sessions. The conference will conclude with a dinner Friday evening.

6/2/64

Attachment "W"

OPTICAL SOCIETY OF AMERICA

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

June 8 - 12, 1964

It would be greatly appreciated if you would answer the questions listed below. We are interested in trying to measure whether or not the Conference on Undergraduate Research Programs in Optical Physics has been successful. It is our intention to follow up on this questionnaire again in about a year.

____________________	______________	____________
name	position	date of birth

____________________	___________	________	19_____
college or univeristy	highest degree obtained	where	when

1. Which of the following schemes is used by your department to enable a student to do lab work beyond that which is usually considered pedagogical:

    _____ Honors Programs

    _____ Senior Project

    _____ Advanced Lab

    _____ None

    _____ Other (please specify)

    How many students take part in the above program? _____

    Over what period of time? _______________________

2. If you do not have one of the programs listed in 1. do you know if your department has had any of the programs in the past? _____ yes _____ no

________________	________________	____________
which program	number of students	period of time

3. What texts in Optics have you been using recently?

4. During which year is Optics normally taught? __________ sophomore, junior, . . .) How many semester or quarters are devoted to Optics? ________ Is Optics _____ Optional, or _____ Required? Do you offer a lab course with Optics? _____ yes _____ no

4. (cont.)
Which of the following do you use as some of your Optics experiments?

___ Minor and White

___ C. Harvey Palmer

___ Cenco

___ your own experiments

___ other (please specify)

5. Do you offer a course in Optics at an undergraduate level higher than in, say, Jenkins and White, Morgan's text, etc.? ___ yes ___ no i.e., at a level of Strong's text, Andrew's text or Ditchburn's?

To your knowledge, has there ever been such a course offered in your department to undergraduate physics majors? ___ yes ___ no

6. In your course in Optics, about what distribution of emphasis do you place on the following: geometrical optics _____%, physical optics _____%, special topics (i.e., coherence, radiometry, etc.) _____%.

7. Do you have ___machine shop facilities, ___machinist, ___electronics technician?

8. Do you avail yourself of government surplus equipment made available through the Department of Health, Education and Welfare (HEW)? ___yes ___no

What particularly useful optical equipment have you obtained through HEW in the past few years?

9. Is there anything particularly unique about the geographic location of your college or university? (in relation to optical physics, i.e., availability of long unobstructed paths, height above sea level, ability to see aurora, etc.)

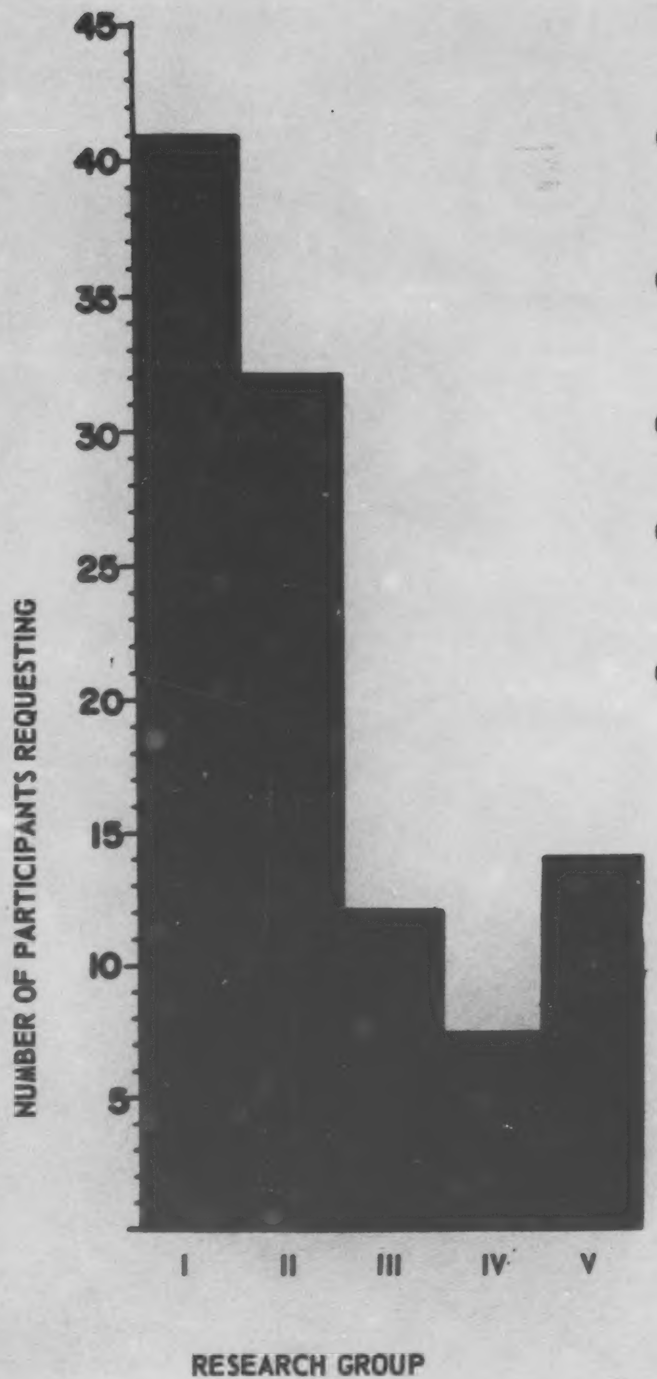
10. Are you doing any research in optical physics? (specify)

11. Have you observed a lack of interest in optical physics on the part of your students?

12. What do you consider your chief obstacles in doing research at your college or university?

FIGURES

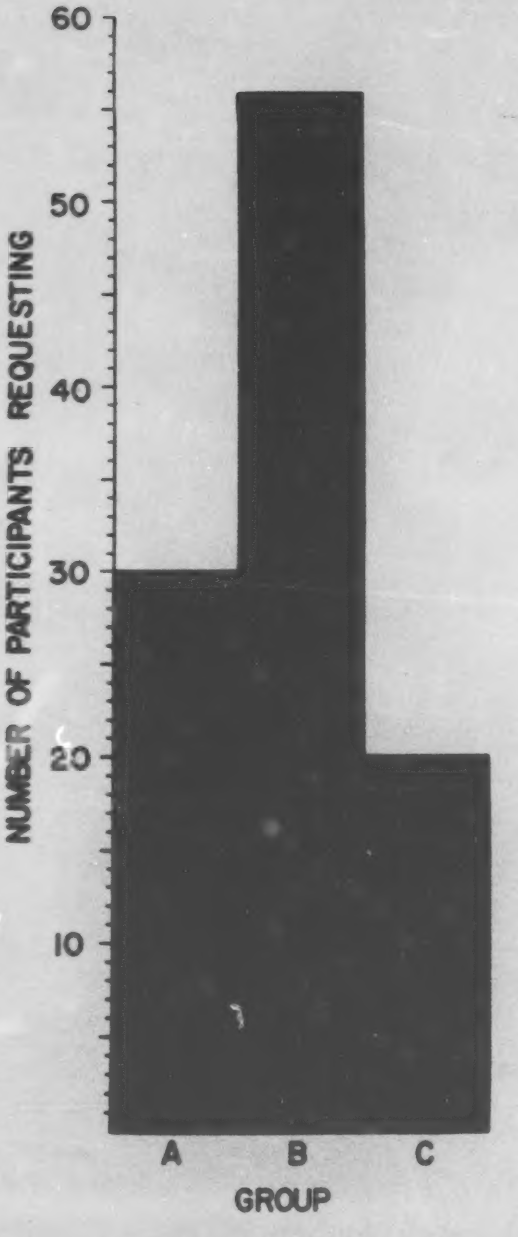
RESEARCH PREFERENCE



GROUP I – Coherence Effects
Lasers
Non-Linear Optics
Magneto-Optics
GROUP II – Spectroscopy-atomic, molecular, solid state
Interferometry
Fluorescence & Luminescence
GROUP III – Radiometry & Photometry
Sources & Detectors
Far Ultraviolet & Infrared
GROUP IV – Atmospheric & Space Optics
Astronomy
Metrology & Space Surveillance
Aurora & Airglow
GROUP V – Optical Materials
Thin Films
Fiber Optics
Optical Constants
Polarization
Geometrical Optics

Figure 1

SUPPORTING ASPECTS PREFERENCE



GROUP A
- Available time for research
- Consultant aid from field experts
- Summer employment in optical industry for Professor, Student

GROUP B
- Financial support
- Equipment - surplus and other
- Reference materials

GROUP C
- Education and curriculum
- Professors
- Students

Figure 2

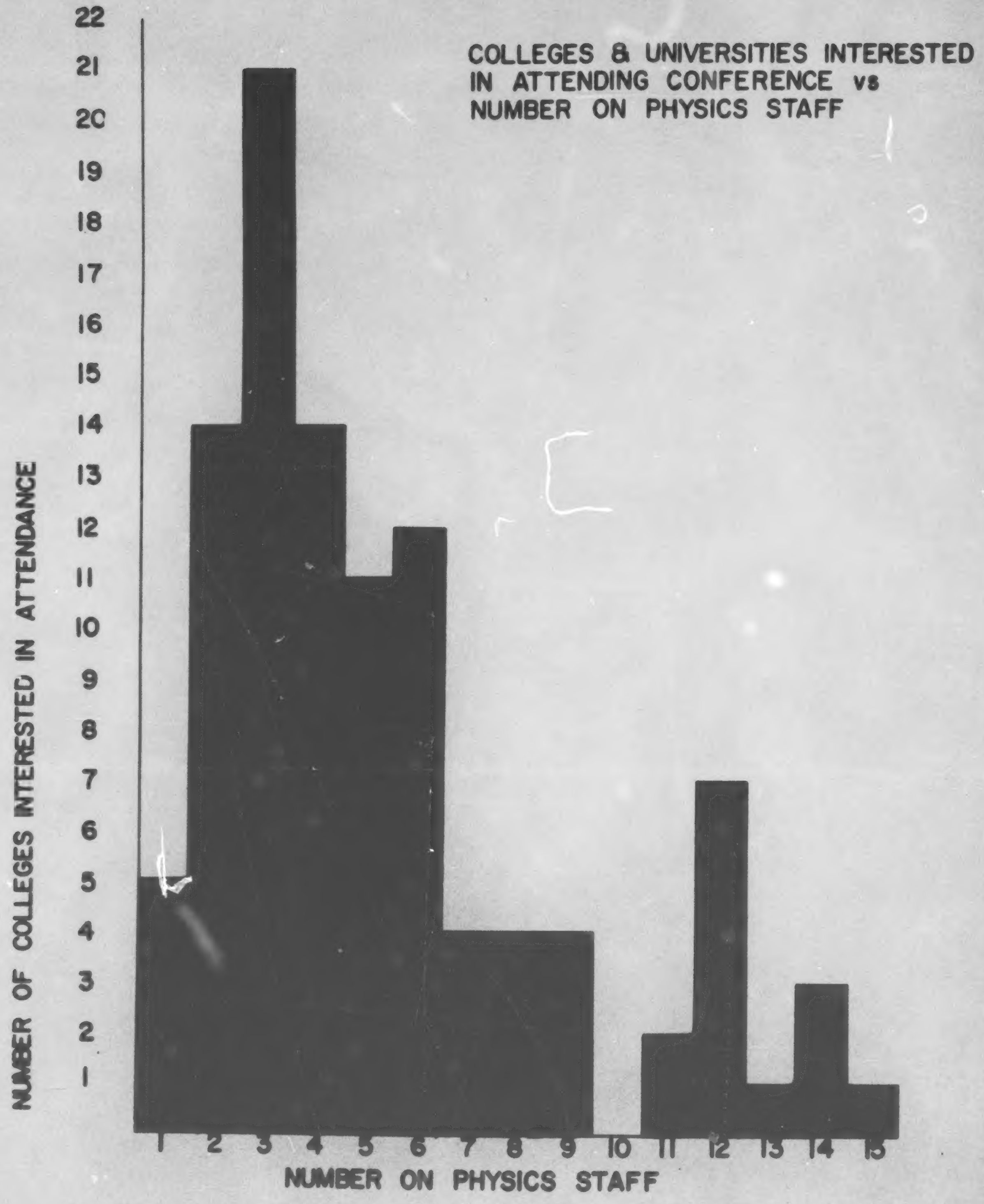

COLLEGES & UNIVERSITIES INTERESTED IN ATTENDING CONFERENCE vs NUMBER ON PHYSICS STAFF
NUMBER OF COLLEGES INTERESTED IN ATTENDANCE
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
NUMBER ON PHYSICS STAFF

Figure 3

AGE DISTRIBUTION OF PARTICIPANTS

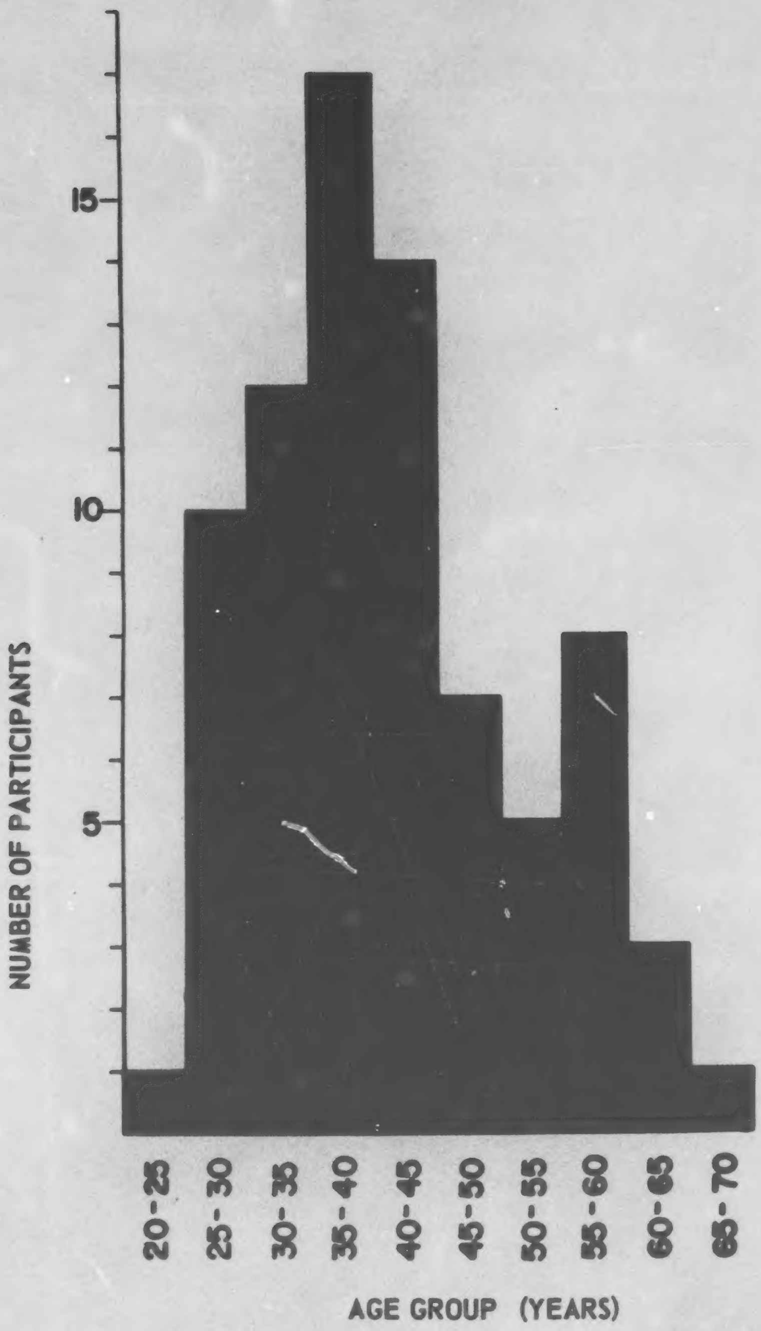


Figure 4

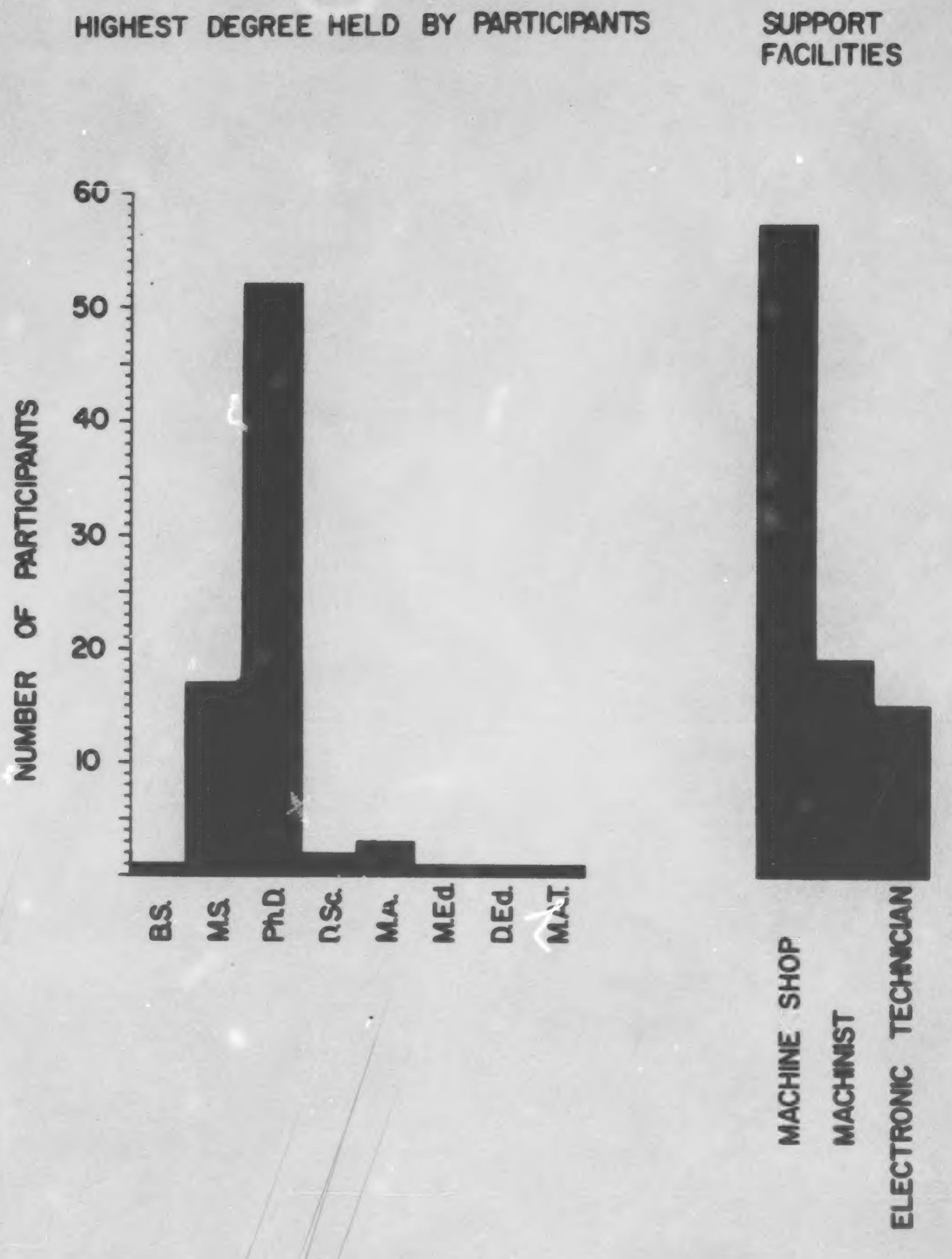

HIGHEST DEGREE HELD BY PARTICIPANTS
NUMBER OF PARTICIPANTS
60
50
40
30
20
10
B.S.
M.S.
Ph.D.
D.Sc.
M.A.
M.Ed.
D.Ed.
M.A.T.
SUPPORT FACILITIES
MACHINE SHOP
MACHINIST
ELECTRONIC TECHNICIAN

Figure 5

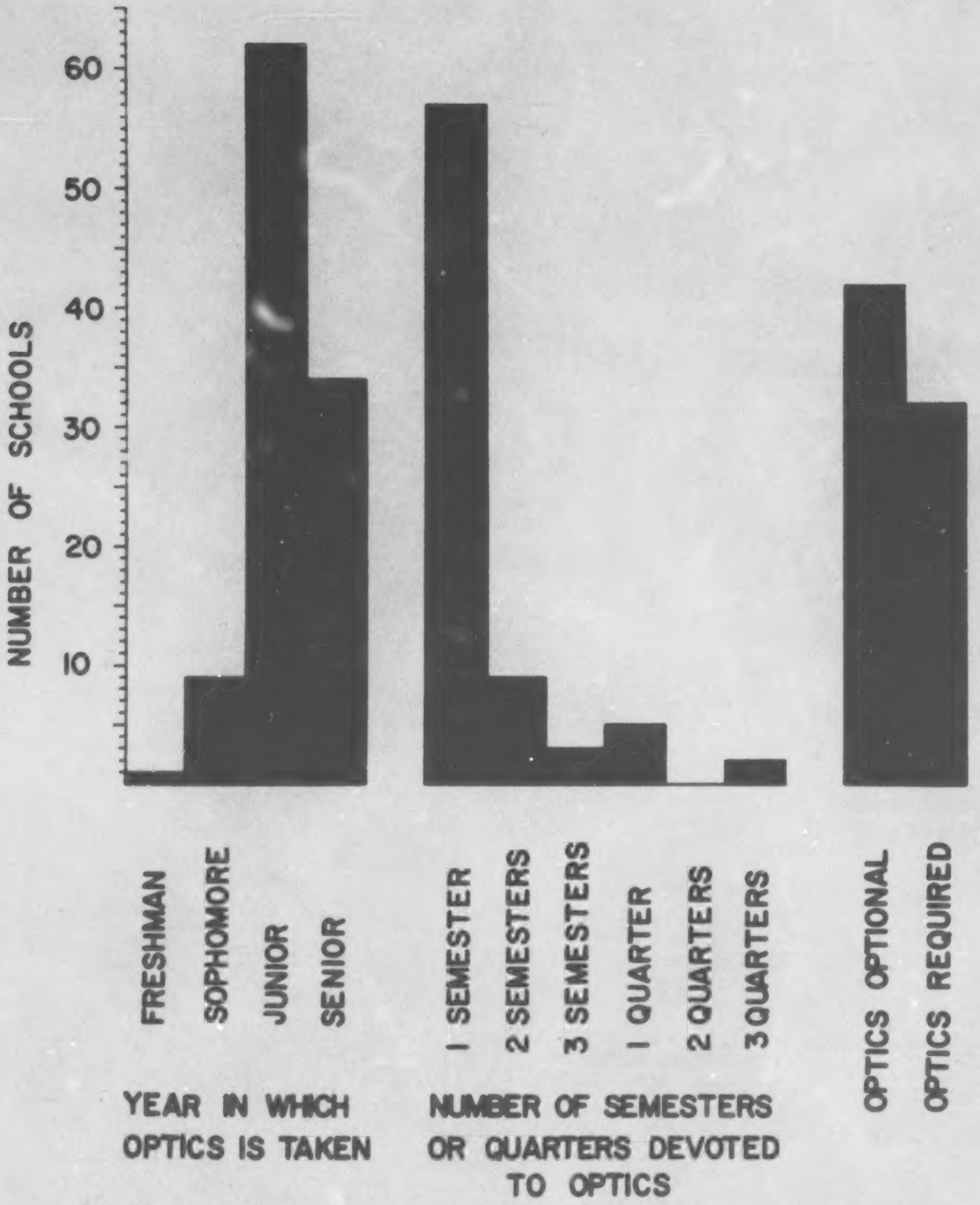
NUMBER OF SCHOOLS
60
50
40
30
20
10
FRESHMAN
SOPHOMORE
JUNIOR
SENIOR
1 SEMESTER
2 SEMESTERS
3 SEMESTERS
1 QUARTER
2 QUARTERS
3 QUARTERS
OPTICS OPTIONAL
OPTICS REQUIRED
YEAR IN WHICH OPTICS IS TAKEN
NUMBER OF SEMESTERS OR QUARTERS DEVOTED TO OPTICS

Figure 6

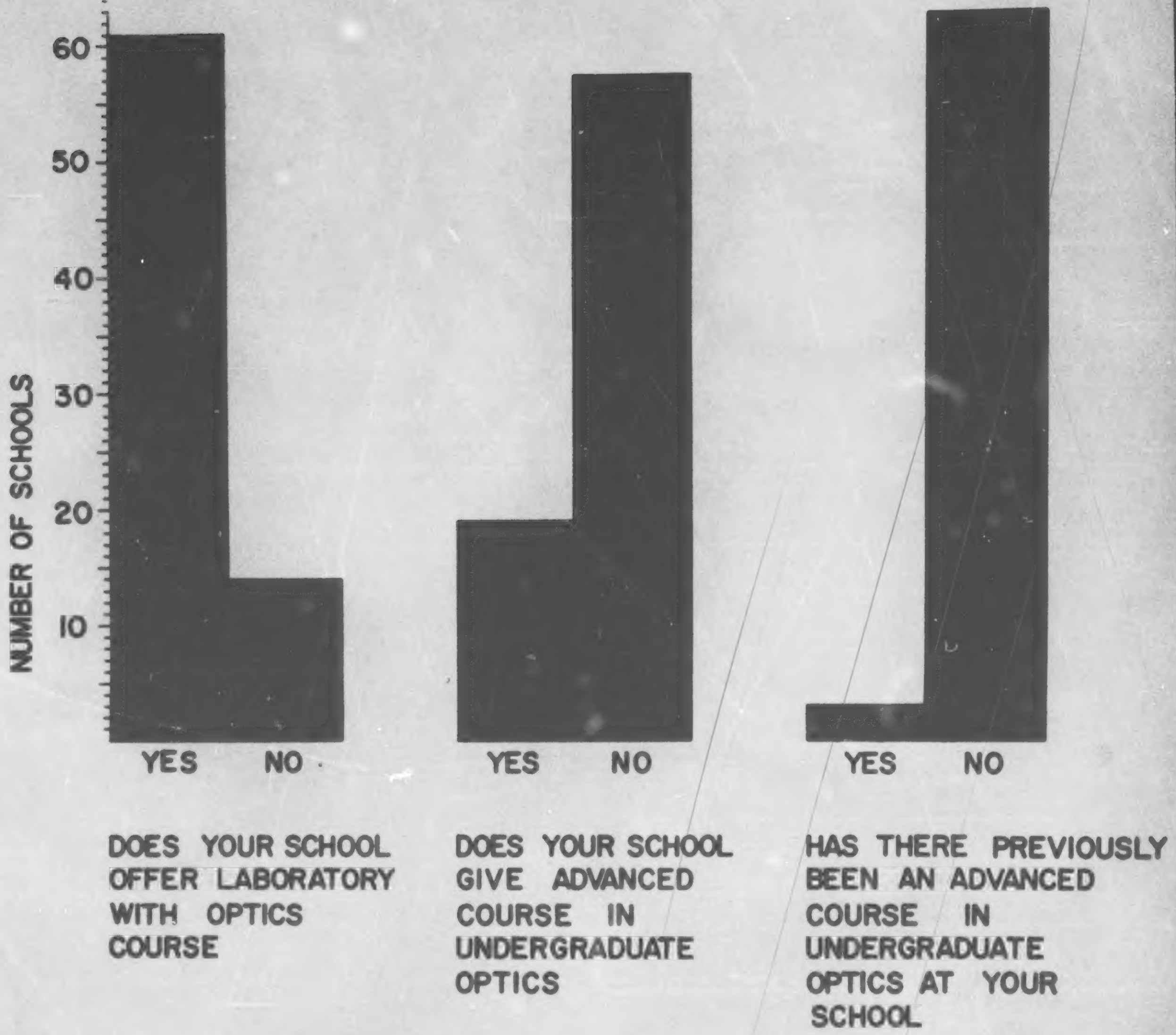
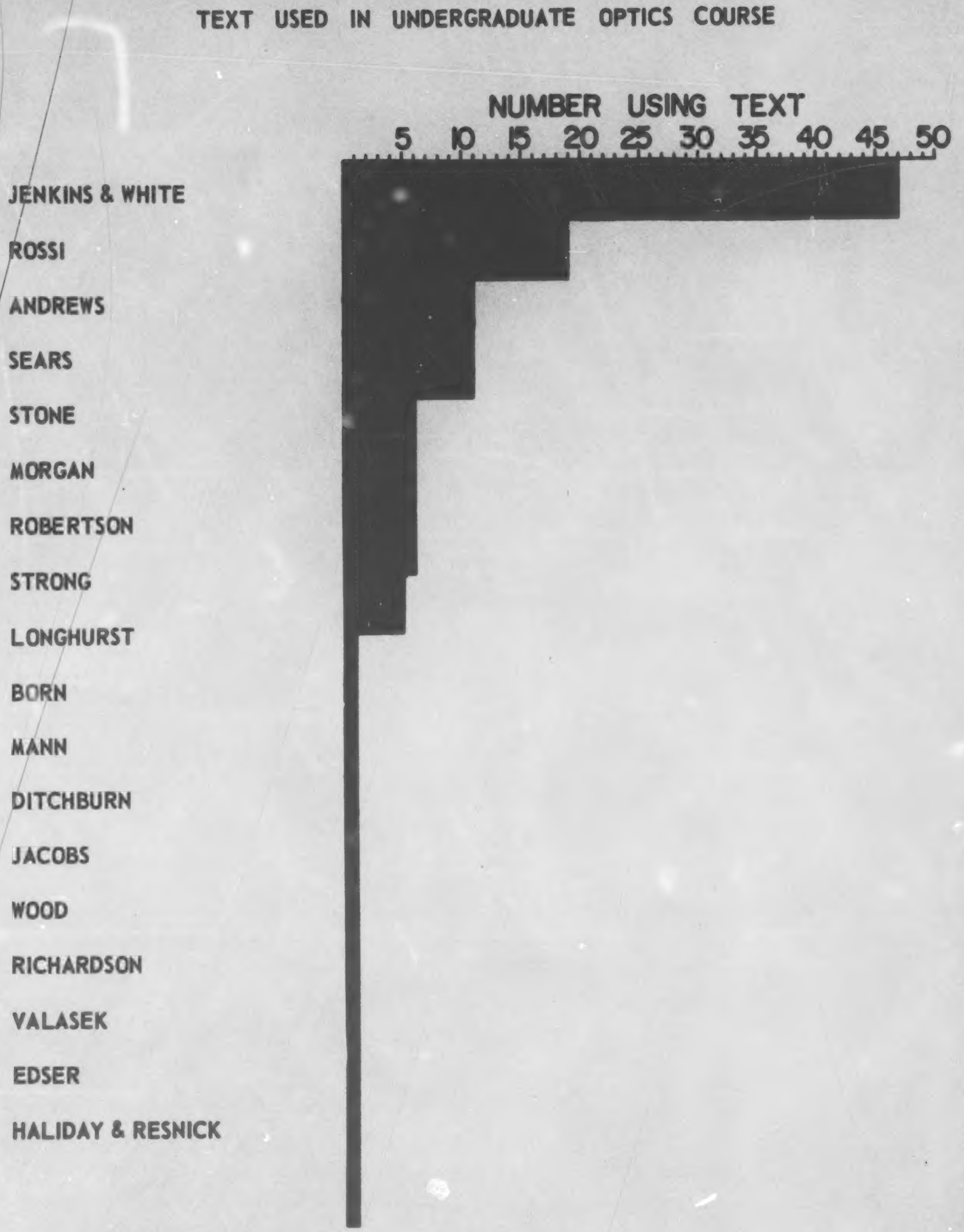

NUMBER OF SCHOOLS
60
50
40
30
20
10
YES
NO
YES
NO
YES
NO
DOES YOUR SCHOOL OFFER LABORATORY WITH OPTICS COURSE
DOES YOUR SCHOOL GIVE ADVANCED COURSE IN UNDERGRADUATE OPTICS
HAS THERE PREVIOUSLY BEEN AN ADVANCED COURSE IN UNDERGRADUATE OPTICS AT YOUR SCHOOL

Figure 7



TEXT USED IN UNDERGRADUATE OPTICS COURSE

Figure 8

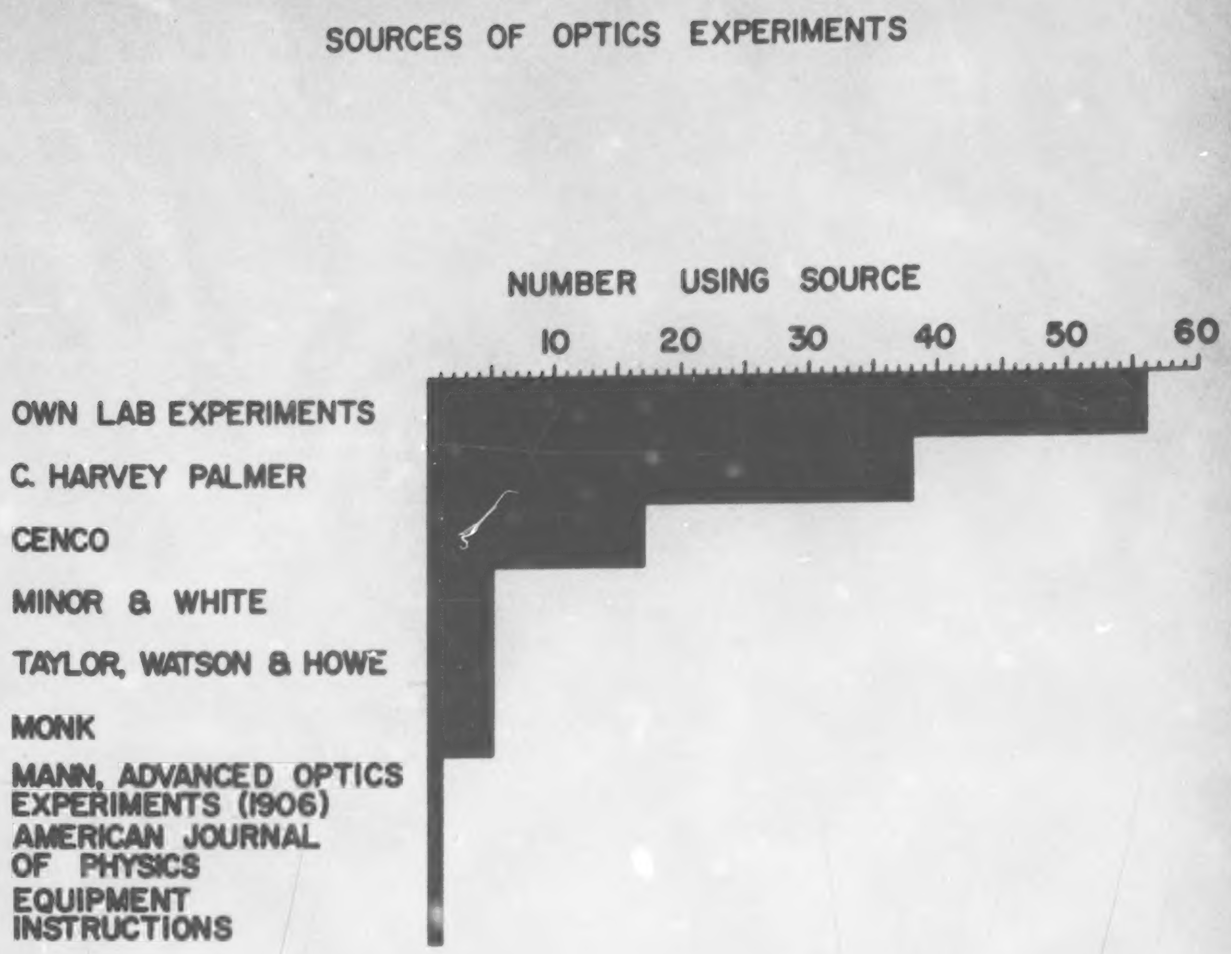
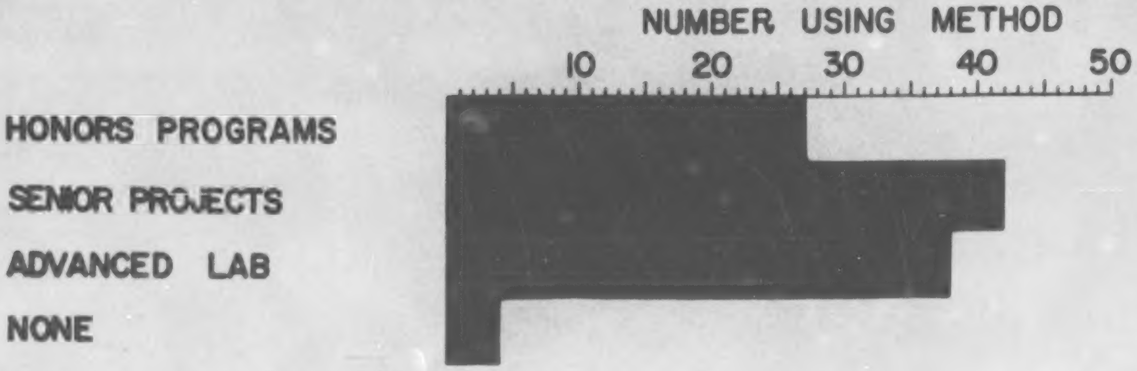

SOURCES OF OPTICS EXPERIMENTS
NUMBER USING SOURCE
10
20
30
40
50
60
OWN LAB EXPERIMENTS
C. HARVEY PALMER
CENCO
MINOR & WHITE
TAYLOR, WATSON & HOWE
MONK
MANN, ADVANCED OPTICS EXPERIMENTS (1906)
AMERICAN JOURNAL OF PHYSICS
EQUIPMENT INSTRUCTIONS

Figure 9

METHODS USED TO ENABLE STUDENT TO PERFORM LABORATORY WORK BEYOND THAT WHICH IS USUALLY CONSIDERED PEDAGOGICAL



OTHER

- RESEARCH AIDS
- WORK SCHOLARSHIPS
- UNDERGRADUATE RESEARCH PROGRAM
- PHYSICS CLUB PROJECTS
- WORKING WITH FACULTY
- RESEARCH PARTICIPATION
- SPECIAL TOPICS
- RESEARCH ASSISTANT
- SPECIAL PROBLEMS
- INDEPENDENT STUDY & RESEARCH
- SEMINARS
- SENIOR THESIS
- INDEPENDENT STUDY

Figure 10

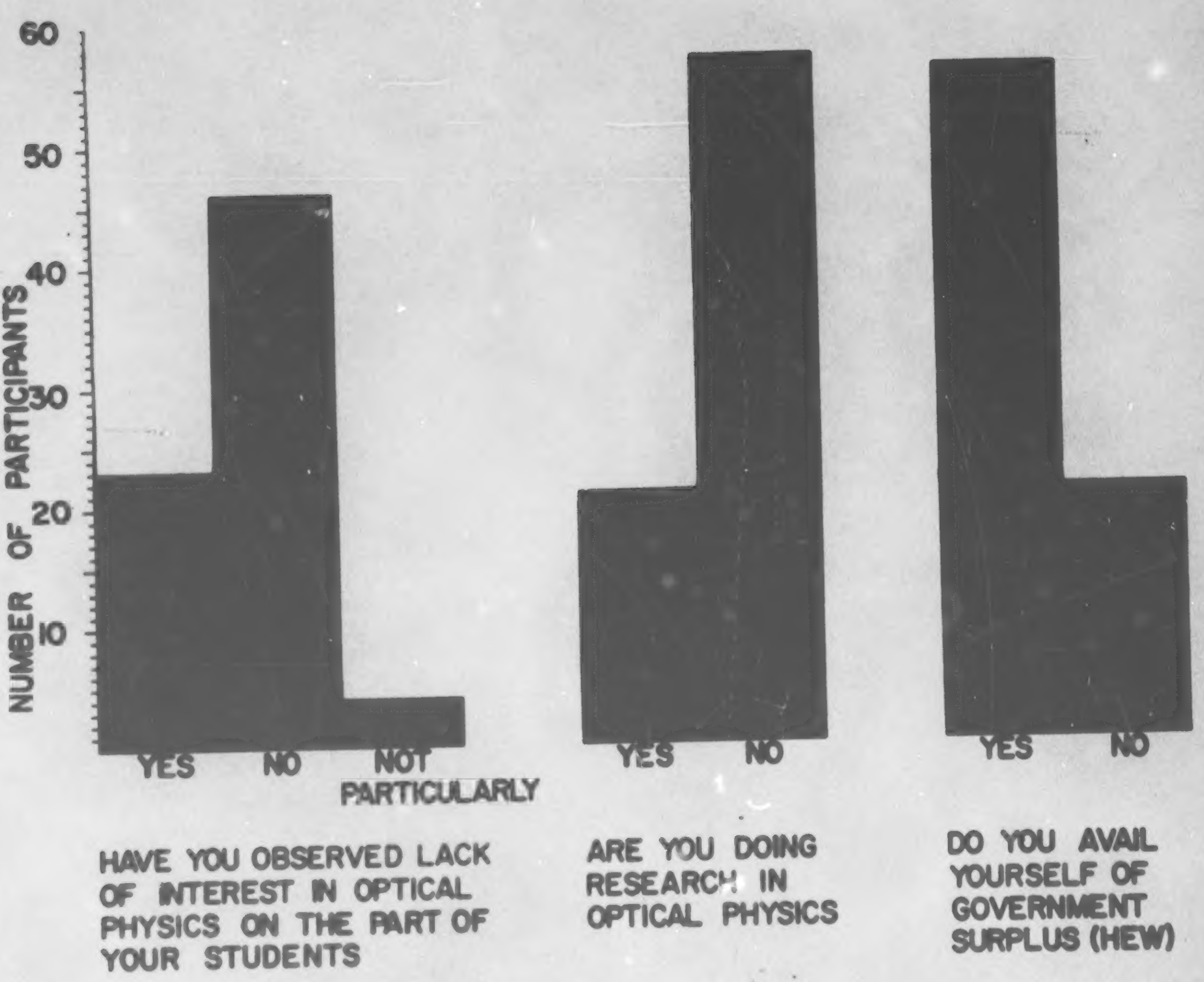
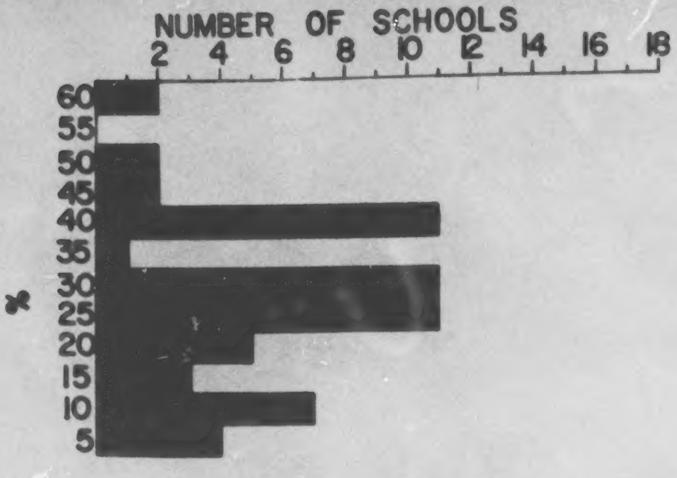
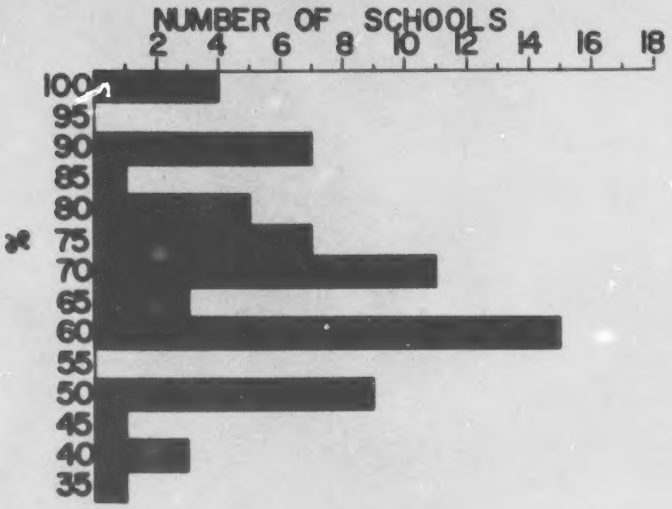

NUMBER OF PARTICIPANTS
60
50
40
30
20
10
YES
NO
NOT PARTICULARLY
HAVE YOU OBSERVED LACK OF INTEREST IN OPTICAL PHYSICS ON THE PART OF YOUR STUDENTS
YES
NO
ARE YOU DOING RESEARCH IN OPTICAL PHYSICS
YES
NO
DO YOU AVAIL YOURSELF OF GOVERNMENT SURPLUS (HEW)

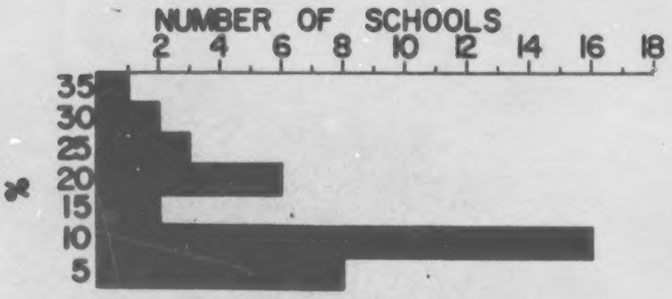
Figure 11



% OF COURSE DEVOTED TO GEOMETRICAL OPTICS



% OF COURSE DEVOTED TO PHYSICAL OPTICS



% OF COURSE DEVOTED TO SPECIAL TOPICS

Figure 12

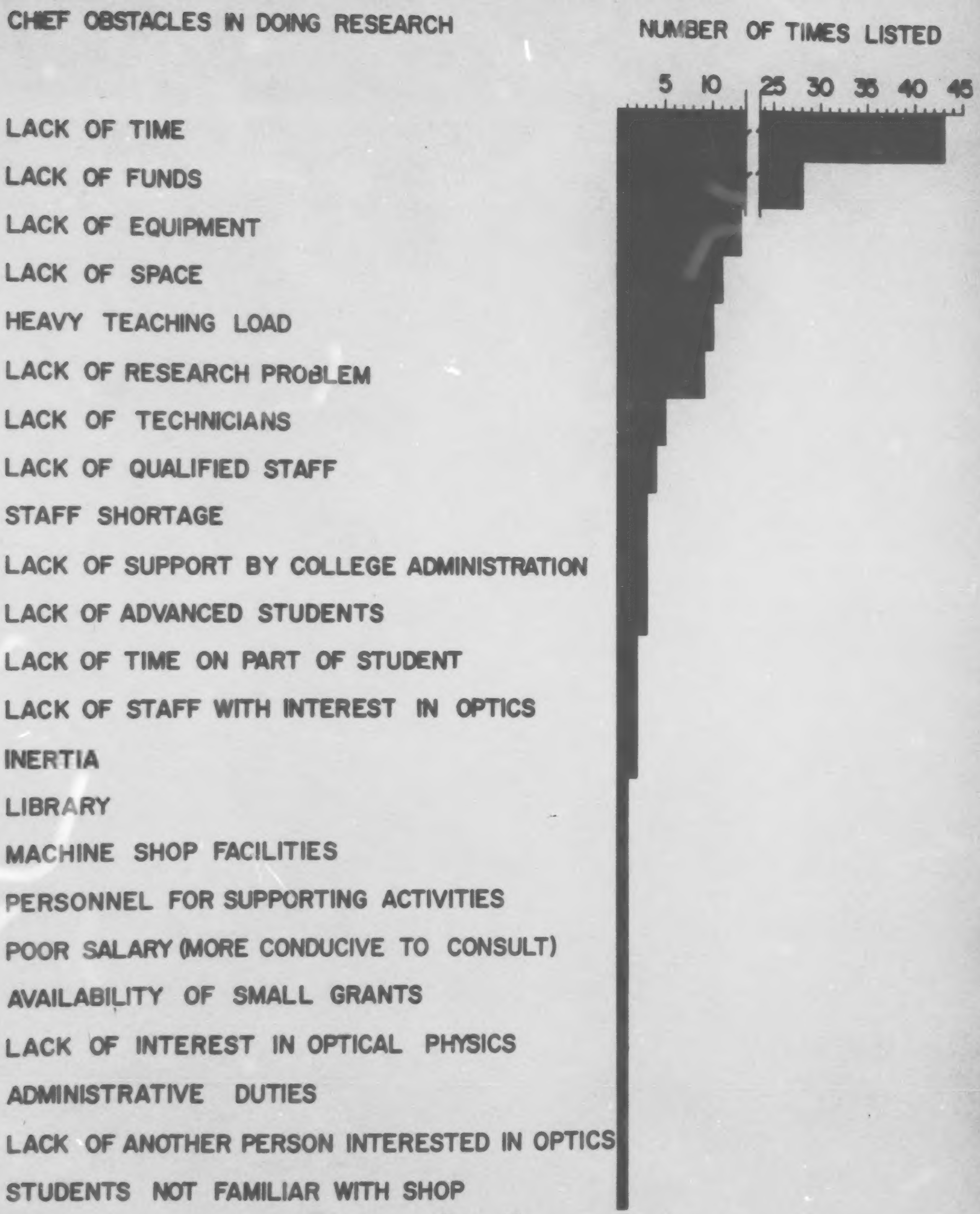
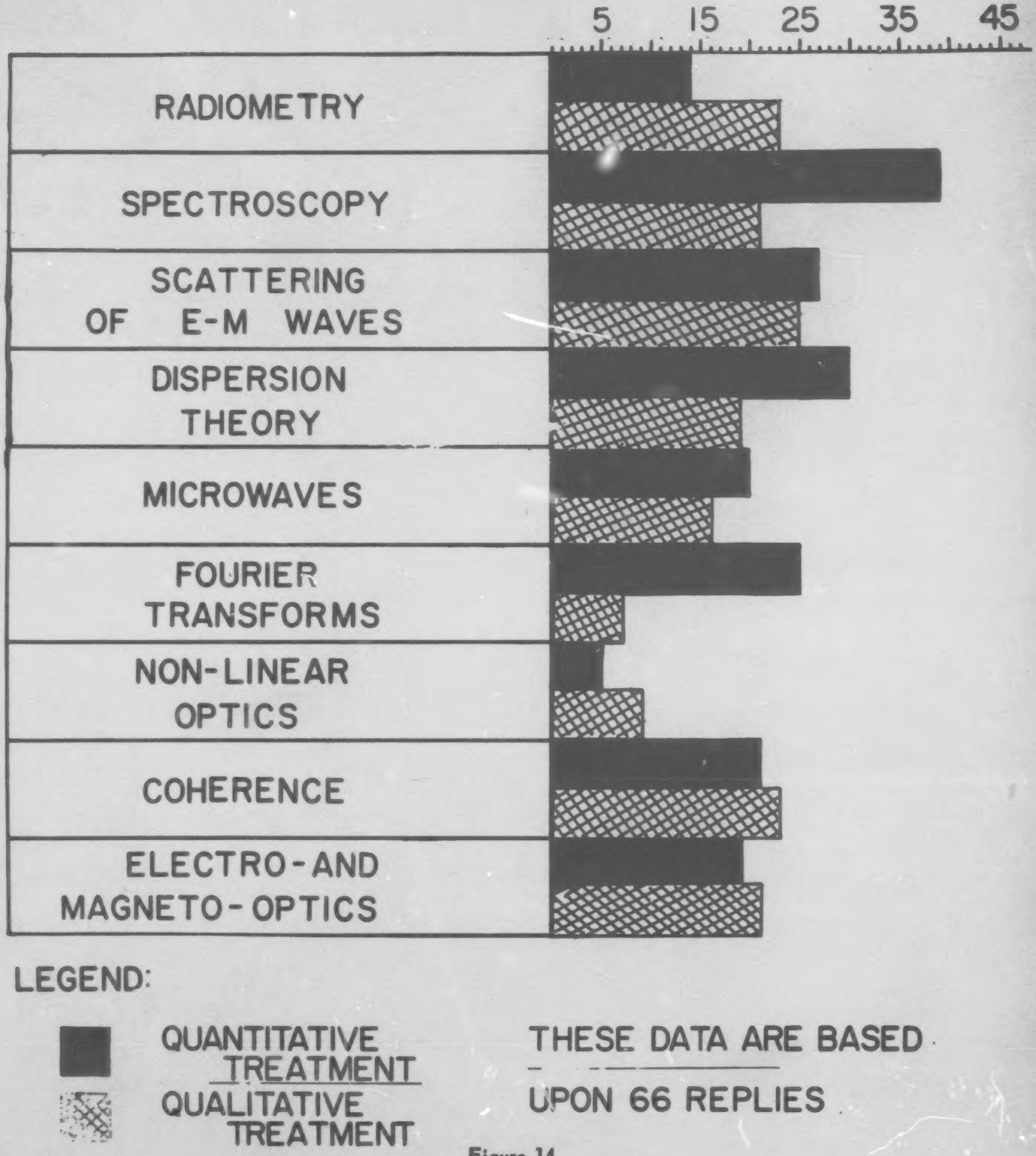

CHIEF OBSTACLES IN DOING RESEARCH
NUMBER OF TIMES LISTED
5
10
25
30
35
40
45
LACK OF TIME
LACK OF FUNDS
LACK OF EQUIPMENT
LACK OF SPACE
HEAVY TEACHING LOAD
LACK OF RESEARCH PROBLEM
LACK OF TECHNICIANS
LACK OF QUALIFIED STAFF
STAFF SHORTAGE
LACK OF SUPPORT BY COLLEGE ADMINISTRATION
LACK OF ADVANCED STUDENTS
LACK OF TIME ON PART OF STUDENT
LACK OF STAFF WITH INTEREST IN OPTICS
INERTIA
LIBRARY
MACHINE SHOP FACILITIES
PERSONNEL FOR SUPPORTING ACTIVITIES
POOR SALARY (MORE CONDUCIVE TO CONSULT)
AVAILABILITY OF SMALL GRANTS
LACK OF INTEREST IN OPTICAL PHYSICS
ADMINISTRATIVE DUTIES
LACK OF ANOTHER PERSON INTERESTED IN OPTICS
STUDENTS NOT FAMILIAR WITH SHOP

Figure 13

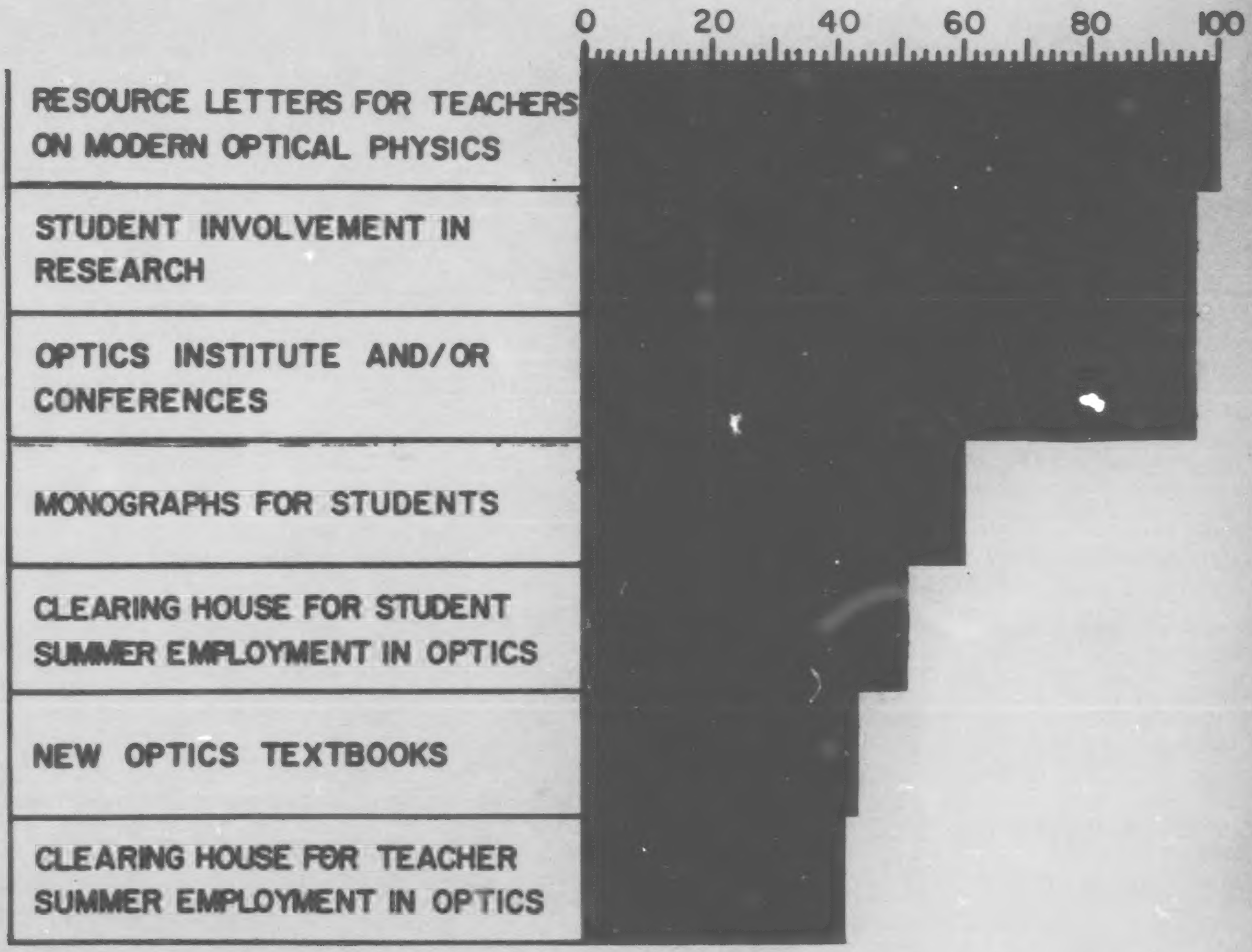
QUESTION: ARE THE FOLLOWING BEING TAUGHT ANYWHERE IN YOUR CURRICULUM?



THESE DATA ARE BASED UPON 66 REPLIES

Figure 14

THE TEACHING OF OPTICS AT THE UNDERGRADUATE LEVEL COULD BE STIMULATED BY:



THESE DATA ARE BASED ON 62 REPLIES

Figure 15

GROUP REPORTS

A-C

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "A" REPORT

Group A was asked to discuss personnel aspects of undergraduate research in optics. We have considered the areas of (1) time for doing research, (2) consultant aid for research in the colleges, and (3) summer employment in the general area of optics for faculty and students.

Discussion of the problem of lack of time for research produced no solution which can be handled by committee action. The consensus of the group is that time is an individual problem which will have to be solved by individual physicists in co-operation with the administrative structure of their colleges. The group recognizes the general need for research time, preferably in half- or full - day blocks. This is inconsistent with teaching loads in excess of contact hours, but does not deter individuals with energy and vision from doing some research.

A block of time may already be available to many faculty members. The possibility of doing research through the scheduled senior, (and possibly junior) laboratory time appears to be quite real. In addition, honors programs and project programs provide time within the usual teaching schedule. This approach to obtaining time seems to be immediately applicable and least objectionable to those who want to keep the teaching load up to some college average.

Another block of time available is the summer. This time usually is partly available, especially if faculty members can obtain some compnesation for their effort. This problem has some possibility of solution by group action through summer employment by industry and government. This aspect will be discussed in a later section.

In order to provide time to initiate research projects, group action by optical specialists can be of great help by indicating areas of research of scientific interest. Perhaps the reports of the Groups I-V will suffice for the next two years. Publication of "Research Letters" similar to the AAPT "Resource Letters" may be a means of helping a person get started. Included in such a letter would be a general discussion of the problem area, bibliography, names of current investigators, and names of persons around the country who would be willing to discuss the problem with the prospective researcher. Based on interest in the "Research Letters," publication of reprint volumes should be considered. A formal consultant program at this time seems to be premature, although some informal arrangements might be made through the structure of various visiting scientists programs.

Schools should be encouraged to contact larger universities, government laboratories, and industries, in their geographic area which are doing related research work. Informal discussions with interested parties will probably be cheaper and more fruitful than a formal program of consultants. The report of this conference will provide a good starting point for the identification of those persons who would help the college faculty member. With some effort on the part of the executive board of the Optical Society of America, the list could be readily expanded. The prestige of the OSA should be used to encourage the optical researchers to welcome the college man, and the OSA should inform its members of this program. The OSA should appoint a standing committee of researchers in optics and small college faculty members to determine areas in which research in small colleges is feasible. This committee should receive reports of the informal conferences when the discussions open up new problem areas.

Summer employment for faculty and students in the field of optics should encourage interest in optics. The main problem with summer employment is the mechanism through which companies and college people achieve and maintain contact. Group A recommends that the OSA send a letter requesting industry and government participation in a summer employment program be sent to research groups over Dr. Williams's and/or Dr. Taylor's signature. Replies will be sent to the OSA executive offices for tabulation.

Assuming there is significant interest in the program, the list of available jobs will be sent to applicants for this conference. By restricting the mailing list to applicants for this conference, we hope to achieve selection of interested small college personnel without the added burden of a national selection committee.

In addition to the list of opportunities, a letter explaining the purpose will be included. Three application forms for a faculty member and three application forms for students will also be included. These forms will be identified by the OSA letterhead. These are a preliminary type of form which will aid the companies in making an initial choice. Student forms will include a specific endorsement by the faculty member who will be responsible for the initial screening of his students. If the companies are interested, they will then follow-up with their usual personnel procedure. It is suggested that the companies give preferential consideration to these applications. Of course, deadline dates are included. Reply postcards will be included to faculty members so that they can let the OSA office know how many applicants there are to each company.

It is anticipated that the costs of this program to the OSA will be born by the Task Group funds or a separate grant from NSF or industry.

Should a non-uniform distribution of applications develop, the OSA office could, at their discretion, send a follow-up mailing to the original list of possible applicants.

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "B" REPORT

The task assigned to this group was to explore the problem of financial support and material aid for both departmental growth and active participation in research. The research with which this committee is concerned, is on the undergraduate as well as on the graduate level. The "small college" is more vitally concerned here than is the larger college or university.

Material aid and financial support may come from the following sources:

1. The Optical Society of America.

It is the understanding of this group that no such funds for support are available. However, the Society could help in a very significant manner, namely, by appointing a liaison officer to work with the various supporting governmental agencies to accomplish its objectives in this respect. The central office could conceivably become a center for handling of contracts both governmental and industrial; it could serve as an exchange center whereby donated equipment or old but still useful apparatus could be passed on to some needy institution; it could serve in an advisory capacity, directing proposal writers to the proper governmental agency and instructing him in the limitations or forms of such proposals; it could also serve as an information center, publishing circulars listing the various supporting agencies, such as AEC, NSF, etc., or various foundations such as Ford, etc.

2. The College or University.

Usually the department must depend upon its budget. Special funds for support of special activity within the department may be allocated by the institution. This is strictly an institutional problem. However, an active department will fare better than a non-productive one.

3. Government.

(a) Surplus Property Acquisition.

(i) If a liaison officer were to be appointed, then one of his duties would be to work with federal government officials or agents in the various supporting agencies. For example, he should keep abreast of materials declared surplus that would benefit the society members. New programs of interest should be investigated by him and his suggestions by circularized.

Mr. Kersey (Department of Health, Education and Welfare) has advised that the state surplus administrator be contacted and advised of your individual needs. You should request that surplus government listings be mailed to you. He also advised that the state director only orders what you tell him to order. (His suggestions are contained in paragraph 7).

(ii) It is reported that some state supported institutions are unable to participate in this program due to lack of provided funds. It is recommended that the Society use its good offices to convince the person(s) responsible of the utility of this program, so that funds may be made available for this purpose. A responsible person in the institution should be appointed to work with the state director for the furtherance of this program.

(iii) Research Participation

Support for research may be obtained from such government agencies as AEC, NSF, HEW, CAFRC, ONR, etc. Other programs such as matching funds, scientific apparatus construction, etc. offer means for obtaining added equipment. There are many other programs offered by these agencies. Here, as mentioned previously, a liaison officer would be of inestimable assistance in giving proper direction and advice to an applicant for a grant. The committee feels that this problem of research participation is so vitally and fundamentally important, that it is discussed at some length in paragraph 6 of this report.

4. Industry.

This will probably be a long range program. There remains much work to be done in this important area. Industry must be made acquainted with the research potential of the Society as well as its needs. This more than likely will be a "selling program" on the part of the Society. Pamphlets, circulars, etc., describing the work of the Society should be circulated among industrialists. This seems to be a source of almost limitless potential - just barely tapped. Some industries have already initiated donation programs more or less familiar to some of you.

5. Private Sources.

Endowments, personal gifts, etc. Nearly everyone from time to time receives support along these lines and this is either for personal or loyalty to college motives.

6. N.S.F.

Outside financial support is normally vital to the existence of a modest research program initiated by a college investigator. This conference recognizes that the existing criteria used by at least one federal agency, the National Science Foundation, dictate strongly against its support of any such program. The committee feels that this situation requires of NSF either a broadening of its present criteria for research support or the initiation of a new program of support directed to the specific needs of the colleges. To this end, it is recommended that OSA suggest to the Commission on College Physics, which has already recognized the problem of research at the college level, that it immediately documents its case to NSF. Since this is a matter of urgency to the present group, it is further recommended that if the Commission cannot take immediate action that the Participants of this Conference be called upon to present their own case to NSF.

7. Special Report from Mr. C. W. Kersey, Personal Property Branch H.E.W. How to derive maximum benefits from the Surplus Property Utilization Program.

I. Get to know and keep in close contact with your state agency for surplus property.
    A. Invite him to your campus to meet with faculty.
    B. Explain and demonstrate to him what you are doing and your goals. (The more he knows about you and what you are doing, the greater the service he will be able to render).

C. When visiting the state agency's distribution center, leave a list of special items of property needed by your school. If you have a catalog showing a picture of the item leave that with him also.

D. Offer to help him screen and select the type of property your school uses and for which a need exists.

E. Share ideas, pictures, slides and models, ways that you have used surplus property in your program.

II. Plan Ahead.

A. Pick up items of property when you first see it at the distribution center. They may not be there if you wait until your next visit or when need arises.

B. Pick up components from time to time and construct pieces of equipment needed.

C. Do not wait until you desire to use a piece of equipment to make request for such an item from your state agency. Give him advance notice and time to try and locate the item for you.

III. Sharing "Ideas In Action".

A. Review available literature and material as how to adapt surplus property for useful purposes.

1. Edmund's catalog
2. Jaeger catalog
3. American Science Center

4. Outer Space Photography - Henry E. Paul
5. Photography through Monoculars, Binoculars, Telescopes
6. Fawcett Publications
7. Amateur Astronomy Handbook (Fawcett, 95¢)
8. Science and Mechanics # 586
9. Techniques Notes Tips
10. Popular Science
11. Popular Mechanics
12. Science Illustrated
13. Visit other institutions and see what they have done with surplus property.

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "C" REPORT

The members of Group C agree that optics should remain an important part of the undergraduate physics curriculum. In view of the Needs in Optics report, which indicates a decided shortage of students doing graduate work in optics, it is recommended as the initial phase of Task V, Education in Optics, that the attached questionnaire be sent to all physics departments in colleges and universities in the U.S. in order to gain some measure of the present level of undergraduate optics preparation. It is hoped that this questionnaire can accompany the mailing of copies of "Careers in Optics".

There is a feeling that the apparent decrease in optics training may be symptomatic of more general problems in physics teaching, in which increasing amounts of formerly graduate material are being shifted into the undergraduate curriculum without a corresponding transfer into the secondary school level.

The following recommendations are made in connection with the teaching of optics in the undergraduate curriculum, particularly for students planning further experimental or theoretical work in physics:

1. That the introductory physics courses include material on optics which is at the level and extent of the text by Halliday and Resnick.
2. That further course work be offered such that the level of optics instruction be at least in correspondence with the R-curriculum recommendations of the Second Ann Arbor Conference.

1. Is a course in OPTICS being offered in your school? _____Yes
_____No

2. If so, by which department? _____Physics _____Engineering
_____Other Hours credit _____3-4 _____6-8 _____Other
Is laboratory work offered in optics above the introductory level? _____Yes _____No

3. Title of OPTICS course: _______________________________

4. Is the course: __________required, __________optional.

5. Total hours of physics (including introductory course) required for bachelor's degree. _____2-25, _____26-30,
_____31-35, _____36-40, _____41-45, _____46 or more.

6. Average number of physics graduates per year. _____1-5,
_____6-10, _____11-15, _____16-20, _____21-30, _____30-50,
_____50 or more.
Approximate percent who take OPTICS _____20% _____40%
_____60% _____80% _____100%

7. Author(s) of text currently in use in OPTICS
_____Andrews
_____Born & Wolf
_____Jenkins & White
_____Morgan
_____Robertson
_____Rossi
_____Sears
_____Sommerfeld
_____Stone
___Strong

8. At what level(s) is the course offered?
_____Sophomore, _____Junior, _____Senior
Average enrollment in course _____1-5 _____6-10 _____11-15
_____16-20 _____21-30 _____30 or more

9. Courses generally taken before enrollment in OPTICS
_____Mechanics _____Electricity & Magnetism _____Modern Physics
_____Other

10. Author(s) of textbook used in Introductory Physics course which is taken prior to the course in OPTICS.

_____Halliday & Resnick _____Shortley & Williams _____Other

_____Morgan _____Weber, White, Manning

_____Sears & Zemansky _____White

11. Do you offer a graduate course in OPTICS? ____Yes, ____No

If so, give course title ______________________________

Text used ______________________________

12. Are the following topics being taught anywhere in your curriculum? Check level of treatment also.

	Treatment	
	Quantitative	Qualitative
_____Radiometry.................	_____	_____
_____Spectroscopy..............	_____	_____
_____Scattering of E-M Waves...	_____	_____
_____Dispersion theory.........	_____	_____
_____Microwaves................	_____	_____
_____Fourier transforms........	_____	_____
_____Non-linear optics.........	_____	_____
_____Coherence.................	_____	_____
_____Electro- and Magneto-optics....................	_____	_____

13. The teaching of OPTICS at the undergraduate level could be stimulated by:

____Optics institutes and/or conferences

____Monographs for students

____Clearing house for teacher summer employment in optics

____Clearing house for student summer employment in optics

____Resource letters for teachers on modern optical physics

____New optics textbooks

____Student involvement in research.

GROUP REPORTS

I-V

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "I" REPORT

1. The areas of responsibility assigned to Group I consist of (a) coherence effects; (b) lasers; (c) non-linear optics; (d) magneto-optics.

2. A major recommendation of this group is that an OPTICAL HANDBOOK be assembled. The proposed Handbook would be of such a comprehensive nature that it might best be organized under the auspices of OSA. Suggested material to be included is as follows:

   (a) Sections on modern techniques of performing optical measurements, with special attention to current literature.

   (b) Compendium of optical parameters of materials.

The compendium of optical "constants" might well start with an exhaustive literature search. The compilation of existing data will then reveal gaps which might be filled in by measurements at various small colleges willing and able to participate in the program. Optical properties of interest to Group I include the complex index of refraction at least from infrared through ultraviolet, index of refraction as a function of incident power and/or external static fields, capabilities for harmonic generation and mixing, suitability for lasers, properties of detectors, etc. Such a table should enable one to choose a laser, possibly in conjunction with a harmonic generating crystal or Raman effect, to obtain coherent radiation at almost any frequency in the optical region.

The limitations on the range of variables in the proposed Handbook is yet to be determined.

3. The problem of coherence is a fruitful one both from an experimental and theoretical standpoint. Many experiments of fundamental importance can be done by small laboratories with one or two lasers and some auxiliary equipment. Such experiments include interference between independent coherent sources, interference of incoherent sources, information capacity of partially coherent sources, etc. Teaching should emphasize temporal and spatial coherence requirements in wave front division and amplitude division interferometers.

4. Comments concerning the excellent demonstrations with lasers left little doubt that most Participants would obtain at least one if financial barriers were lowered. It was suggested that fifty or more small colleges, oscillating coherently, should approach various manufacturers for a group order and determine if the financial threshold could be lowered. Semiconductor lasers should also be investigated. Motto: "Any optical experiment worth doing, is worth doing again with a laser."

5. Non-linear optics provides an extremely wide field for a small laboratory. The Edisonian method could be used by undergraduates in searching materials for harmonic generation, mixing, limiting, detecting, modulating, etc. Experimental analogs with radio frequency communication techniques may be constructed (example: laser superhet receiver). Modern signal processing techniques in the optical region should be explored.

Inverse effects should be investigated (e.g. inverse Faraday effect).

6. The elementary magneto-ionic theory may be presented to undergraduates quite readily. Demonstration experiments of cyclotron resonance in gaseous plasmas are readily obtained with microwave optical apparatus and surplus magnetron magnets. For laboratories with research magnets, fundamental measurements at infrared and visible wavelengths in solid state plasmas offer a challenge. Non-linear effects should not be overlooked.

7. The following research problems suitable for small laboratories were also discussed:

(a) Optical imaging with coherent and incoherent radiation.

(b) Search for new types of interferometers (utilizing high coherence and consequent long path difference).

(c) Study of coherent mode structures in interferometers and optical waveguides.

(d) New measurement of angular momentum of light.

(e) Resurrection of antique optical phenomena for re-examination with modern techniques and materials.

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "II" REPORT

I. Introduction

In Group II the colleges represented were in the range from 750 to 5000 students. The departments averaged about 4 faculty members. The average number of physics majors graduated each year by these colleges ranged from 1 to 20 students.

The members of the Group came to the conference looking for assistance in the meeting of specific needs of their own, of their departments, or of their school. Interaction with individuals with similar problems and resources was an important phase of the Conference. The majority of the Participants were anxious to improve their competence and their currency in the field of optics. Group II feels the ideas presented in the following sections of this report represent a summary of Conference gains in terms of (1) problem areas delineated, and (2) recommendations for solution.

Group II agreed that there is a spectrum of meanings for the terms study, project, and research. At one end of the continuum is the research study or project for the undergraduate student. Research at this level is seen primarily as a teaching tool and a way of assisting the student to get a feel for the phenomena of physics. A secondary advantage of student research lies in the possibility of attracting good students into the field of optical physics. Research at the other end of the spectrum is used in the classical sense.

Faculty members desire to do research leading to some modest advance in knowledge. From such research the department can profit by being able to attract the more competent new Ph.D's. If the research is of the proper caliber, it is possible for the school to profit from the acquisition of funds for additional equipment and facilities. The Group recognized that most faculty research projects would heavily involve students.

Research is going on at the small college level. In addition, students are being involved in projects, honor studies, and research. Everyone in Group II, however, agreed that additional effort should be made. The following represents projects and research reported by the Group.

Problems Attendant to Starting a Research or Honors Project

Since recognition of a problem is normally the first step in its solution, the Group tried to state the problems that face the initiation of optics research in the represented colleges. The stated problems were neither unique nor universal to the represented colleges. Naturally, all of the problems are subjectively interpreted by the individuals in the group.

1. Lack of time and space to do research. - These problems result from heavy teaching loads, staff shortages, and limited college finances.

   "How does one convince the college administration that time in the schedule must be left for the professor to do research when the problem of adequate secretarial help has not yet been solved?"

2. Training of staff:
   - (a) Relevance: few have adequate background in optics and/or intimately related fields.
   - (b) Currency: much of the training of staff members in optics needs up-dating.
3. Inadequacy of the small departments to provide persons trained in supporting technology, e.g. electronics.
4. Limited shop facilities for making and mating equipment.
5. Lack of information on and familiarity with the sophisticated equipment currently available for purchase or use in large laboratories.
6. Problems of identifying worthwhile projects for:
   - (a) Faculty research - uniqueness and definite scientific value.
   - (b) Undergraduate research - unique but not of definite scientific value.
   - (c) Honors research - independent study.
7. Matching of local abilities and facilities with potentially usable projects.
8. Finding a project - some persons need suggestions of problems to consider.
9. Equipment and Supplies - both "in hand" and sources.
10. Financial resources for research.

Suggested Research Problems

As part of our mandate it was requested that suggestions for suitable research be collected. Listed below are those suggestions that were considered to have potential merit. It is suggested that many of these can be done co-operatively with staff and/or students in the chemistry, or other related departments.

(1) Use laser beam to measure scattering in an arc or plasma jet for electron density measurement.

(2) Interferometric measurements in arc and plasma jet for electron density and temperature distribution.

(3) Ultrasonics for determination of velocity of sound in transparent materials.

(4) Compound semiconductors:

  Dielectric constants - index of refraction

  Fluorescence

  Spectra - absorption, emission - as function of temperature or pressure

  Microtechniques for small crystals

(5) Optical properties of thin films:

  Reflection and refraction

  Magnetic rotation of polarization

(6) Optical characteristics of diatomic molecules

(7) Literature search for specific areas in optics

(8) Optical properties of noble gas compounds

(9) Surface effects

(10) Field emission microscope

(11) X-ray diffraction studies

(12) X-ray activation, study of color centers

(13) Interferometric studies of plasmas in magnetic fields

(14) Isotope shift

(15) Optical activity

(16) Scattering of microwaves from large flat surfaces, e.g. snow covered lake ice as a function of depth, etc.

Sources of problems

Journals:
- Am. J. Physics
- Optics Journals (JOSA, A.O., etc.)
- Scientific American
- Contemporary Physics

Scientific Meetings, national and local
Volumes on research supporting agencies
Handbooks (Physics and Chemistry; AIP, etc.)
(Look for blanks in the various data columns in handbooks)
Visiting scientists program of AIP.
Summer Research and Employment at large labs.
Physical Optics by R. W. Wood

Types of support appropriate to the areas

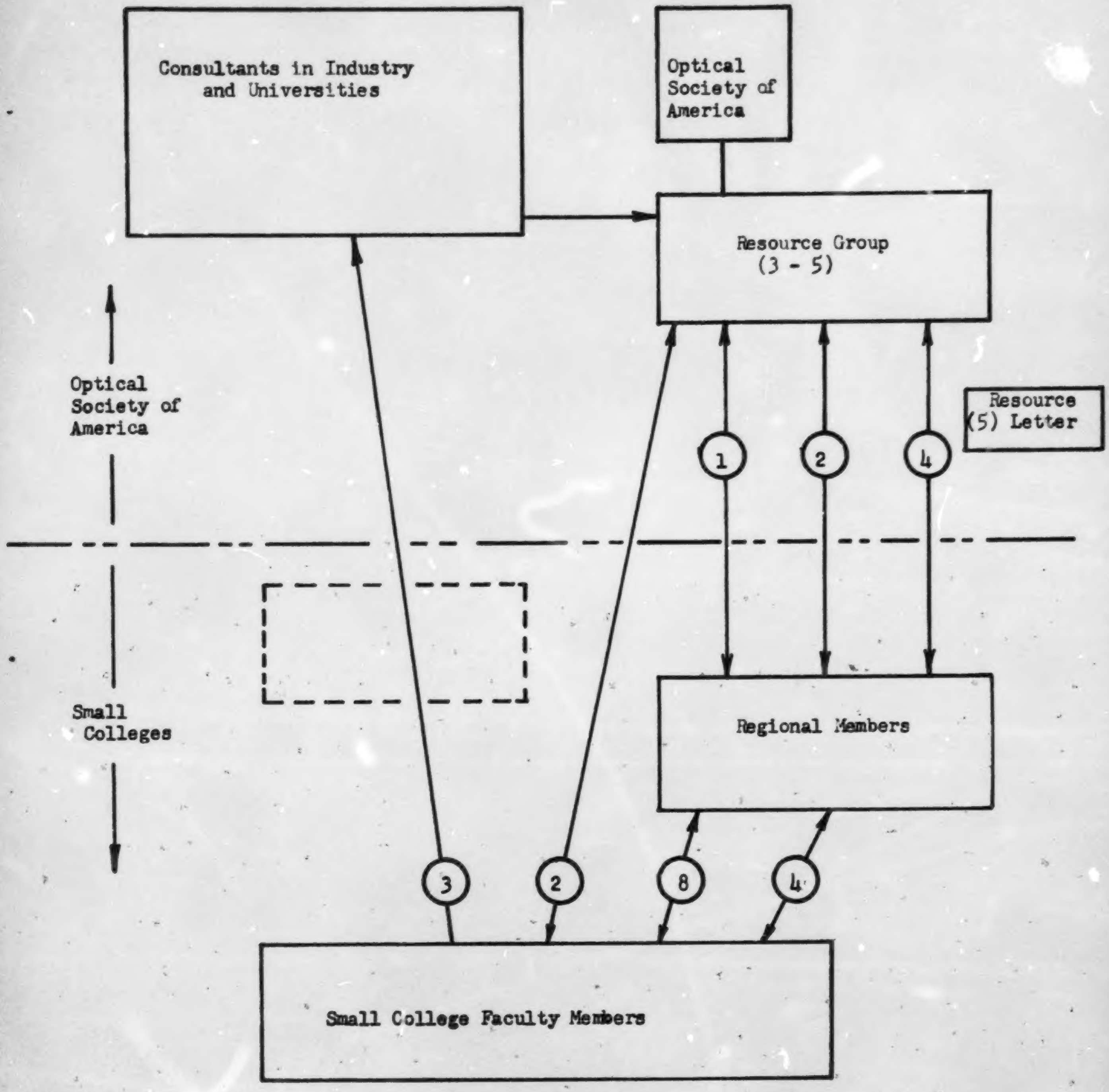
Research Corporation
Volumes on research supporting agencies
Federal agencies, NSF, AEC, DOD, HEW, etc.
Industrial Grants (e.g. Petroleum Inst.)

Recommendations:

Specific recommendations for action came from the Group. There are certain areas where concerted effort is required; here the group has made recommendations to the Optical Society of America.

The individuals of the Group want to return to their campuses with their information, ideas, and resolve and start to work planning a research problem appropriate to their college situation. Their recommendations describe the help they would like to have available and for which they ask assistance.

A. The establishment by the OSA of a Resource Group composed of three to five members of OSA knowledgeable about the members of the Society, their interests, and their willingness to consult with and help a small college faculty member in establishing a research project. To this nucleus could be added six to nine regions with a regional chairman from the small college group as Resource Group members. This suggestion and its operation is flow diagrammed on the next page.


Consultants in Industry and Universities
Optical Society of America
Resource Group (3 - 5)
Optical Society of America
Resource (5) Letter
1
2
4
Small Colleges
Regional Members
3
2
8
4
Small College Faculty Members

(1) Initiating request for help comes from a small college faculty member.

(2) Resource Group suggests a consultant for the small college in its region.

(3) Small college faculty member meets with consultant.

(4) After meeting with consultant, small college faculty member reports problem chosen and any other problems generated.

(5) A research letter embodying problem reports, recent optical advances, and other good-of-the-order items produced by the Resource Group to be sent to all OSA members and small college physics departments.

OSA to obtain NSF funds for above, including travel funds for isolated small college members to journey to the meeting with the consultant.

B. A series of sessions at the OSA, the APS and the AAPT meetings for updating faculty members who have been out of school for some time. This could be essentially oral review papers.

C. The OSA should request funds from the appropriate agencies and initiate a program of small grants to persons attempting to get research going. These grants could be restricted to $500 to $1000 per year for a maximum of three years. It would be assumed that the grantee would, at the end of this time, qualify for a grant from one of the major agencies.

D. A study group for optics in the elementary school should be organized to prepare suggestions for course content at various grade levels, suitable experiments and demonstrations, and lists of readily available materials and equipment.

Miscellany for the "good of the order"

(1) Many companies have educational discounts on equipment purchased for educational use.

(2) Possibility of farmed out research from:
  (a) Industry
  (b) Universities

(3) Find an interesting area and contact an expert for help in isolating a problem.

(4) Research projects for undergraduates not necessarily original to scientific community (Uniqueness not a requirement)

(5) "Supply" house needed for ideas and projects

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

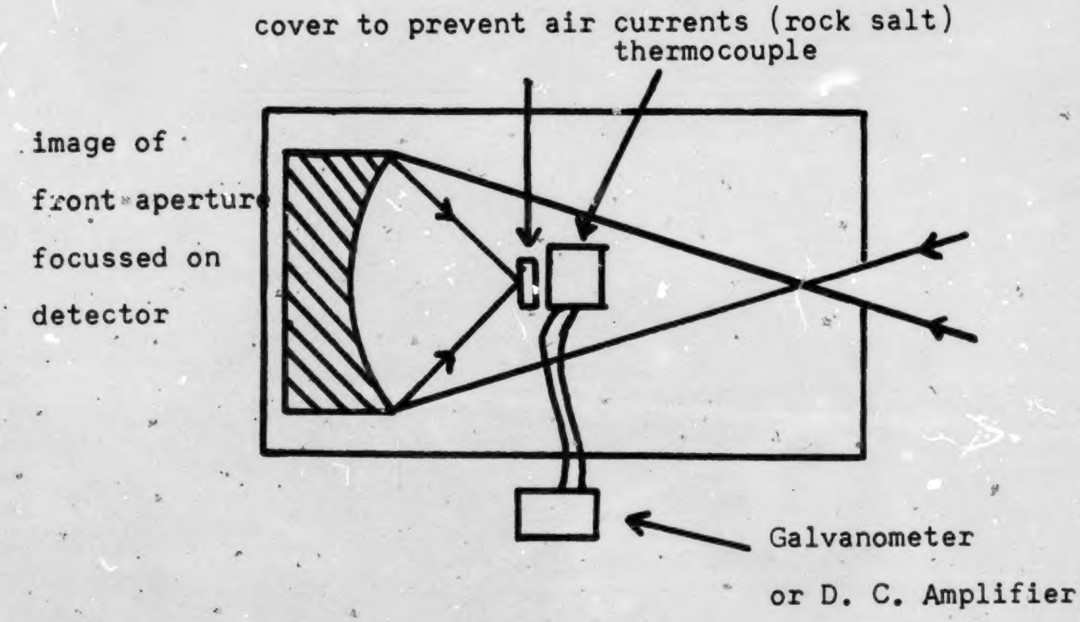
GROUP "III" REPORT

Suggested honors and research projects in these areas: Radiometry & Photometry, Sources and Detectors, Infrared.

During the Group discussions it was noticed that the available facilities varied considerably in the different institutions. Therefore only a brief outline of the experiments is given.

SUGGESTIONS FOR HONORS PROJECTS

1. Construction of a simple radiometer.


cover to prevent air currents (rock salt)
thermocouple
image of front aperture focussed on detector
Galvanometer or D. C. Amplifier

2. Construction of thermocouple.
   See Strong: Procedure in Experimental Physics
3. Construction of PbS infrared detector.
   See Smith, Jones and Chasman: The Detection and Measurement of IR Radiation, Clarendon Press

a. Calibrate cell using a soldering iron as a blackbody

b. Study IR from human body and other objects

c. Tie to a spectograph and study solar spectrum

4. Construction of IR gratings by parallel wires wound over two screws; photographic process; printed circuit techniques; photo engraving; and Ronchi rulings.

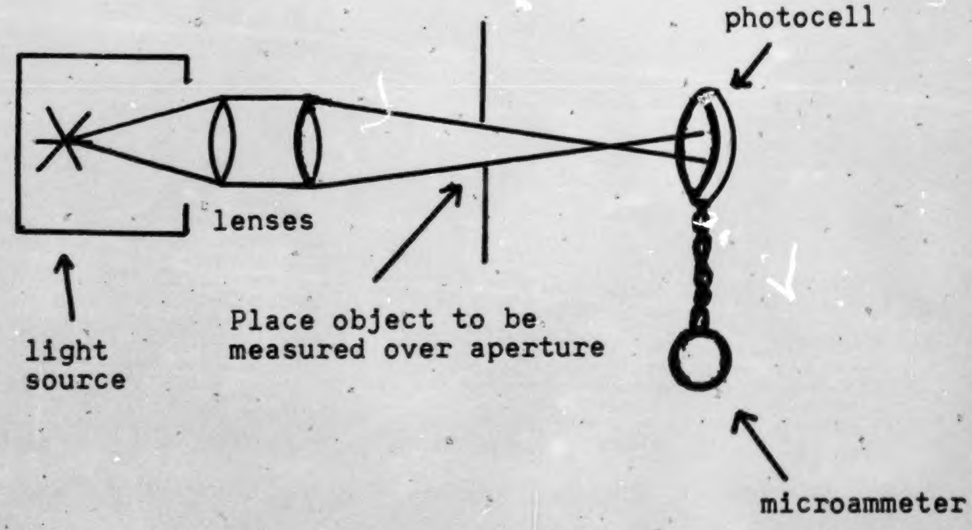
5. Construction of replica gratings if a metal reflecting grating is available.

   (a) Pour collodion over grating surface and let dry.

   (b) Put grating with collodion under water over night. The water runs under collodion film and separates it from grating.

   (c) Mount the film on a glass plate by raising the glass plate up under the film while it floats on the surface.

6. Construct a simple densitometer using a lamp, lens and photocell. (See Brode's book on spectroscopy)


photocell
lenses
light source
Place object to be measured over aperture
microammeter

(a) Made a photographic step-wedge and calibrate photocell as a densitometer.

(b) Determine relative light intensities using the densitometer to obtain the D & H curve for a photographic film.

7. Determination of the temperature of the moon with the simple radiometer or by use of a telescope with a thermocouple detector at the focus as a radiometer. Calibrate the radiometer with a blackbody larger than the entrance aperture of the radiometer. Use a sheet metal cone, paint with flat black paint and heat with boiling water. Measure radiation from moon at different zenith angles and compute transmission by square-root law (Applied Optics, Sept. 1963)
The spectral response of the PbS reduces the atmospheric absorption and the square-root law is valid. If a thermocouple is used, an 8-12 micron band-pass filter will be needed to reduce atmospheric absorption effects. The signal of the calibrated radiometer divided by the transmittance of the atmosphere can be used to calculate the temperature of the moon (390°K for full moon).

8. Determine the temperature of the sun by use of the simple radiometer or by use of an optical pyrometer. A smoked plate could be used as attenuator for the telescope. This could be calibrated by use of a pyrometer. A narrow band-pass filter for telescope to match the pyrometer filter will be needed.

9. Construct a black body and study its radiation using a spectrometer.

10. Construction of a spectral (0.4 - 2 microns) radiometer, using PbS detector, 7500 lines/inch grating, glass prism or band-pass filters (similar to Barnes ES-100 Spectrometer).

11. Construction of infrared polarizers from AgCl sheet. Measure extinction with radiometer.

12. Determination of emissivity of silicon carbide (Carborundum Co., Niagara Falls) found in a Globar. Cut the globar to form blackbody cavity and compare the radiation from this notch with the unnotched surface. Vary the temperature. Also use spectral (10) radiometer to study emissivity as a function of wavelength.

13. Use the spectral radiometer in connection with a water cooled aperture (a loop of copper tubing with cold water passing through it) to determine the emissivity of a body directly by comparing the hot specimen to a black body at the same temperature.

14. Construct an optical pyrometer. (Reference NBS Monograph 41).
    (1) Calibrate the pyrometer against a thermocouple whose current output is known.
    (2) Read brightness temperature of various incandescent light sources. Make correction from brightness temperature to true temperature (Measurement of Radiant Energy, by Forsythe)
    (3) Radiant efficiency of a lamp.
        (a) Measure input electrical power.
        (b) Measure brightness temperature with optical pyrometer.

(c) Use emissivity of tungsten (AIP Handbook) to correct to obtain true temperature.

(d) Measure the tungsten ribbon filament and compute its area using a measuring microscope.

(e) Calculate radiant energy, P, from Stephan-Boltzmann Law using the emissivity of tungsten.

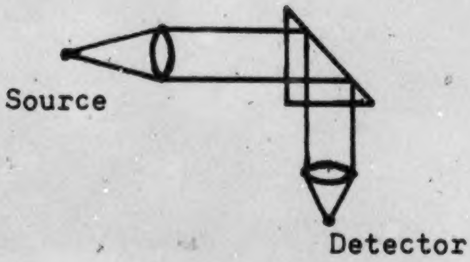
(f) Determine radiant efficiency by

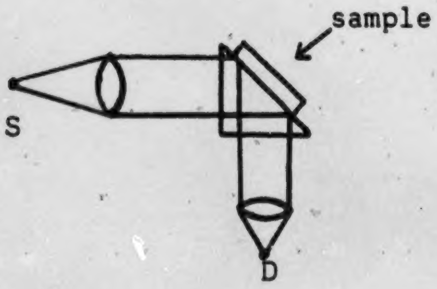
$$\%E = \frac{P\ \text{radiant (watt)}}{P\ \text{input (watts)}} \times 100$$

SUGGESTIONS FOR RESEARCH PROBLEMS

1. Use infrared detector in conjunction with a reflecting telescope to scan the moon and study temperature variations during a lunation.
2. Build a simple coronograph and use infrared film to photograph area around the sun. Could also study scattering of sunlight by pointing a radiometer toward zones around the sun.
3. Study attenuated total reflection for various materials.

Compare detector output with





(Could also use monochromator or filters to measure spectral variation.)

4. Verify Lambert's Law for different kinds of surfaces. Is it a function of wavelength? Consider partial reflection (where angle of reflection = angle of incidence)

5. Cone optics. What happens when a detector is put at the apex of cone? What is gain of cones as a radiation collector? What is effectiveness of cone with a source off the axis of cone? What is effect on radiation collector with distance from cone? Try pyramids made of front surface mirrors. How much of the radiation which enters the cone aperture actually stays in cone? Try various surfaces.

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "IV" REPORT

Group IV was convened for the purpose of considering problems associated with establishing research projects in the areas of atmospheric and space optics, astronomy, meteorology, space surveillance, aurora and airglow. The approach to the Group meetings was two-fold: first, to obtain, share and discuss possible research ideas with several of the excellent Invited Lecturers; second, to discuss the problem areas on the individual college level that are met in attempting to establish undergraduate research programs.

TECHNICAL:

The nature of the research subjects generally implies extensive use of airborne vehicles for primary experimentation. Of the various types of vehicles, only balloons were discussed at any length. Balloon-borne or rocket or aircraft experimentation and supporting research can find a place in a small college program. One major obstacle in considering such field work is that of knowing how to get use of the balloon and related facilities, - a problem that seems prohibitive to small colleges. Dr. Gordon Newkirt (High Altitude Observatory) discussed the procedure in obtaining National Center For Atmospheric Research (NCAR) blessings and support as far as the vehicle and related facilities are concerned. He described possibilities of NCAR piggyback experiments, or experiments mounted on test flight gondolas. The first step for the experimenter is to petition NCAR with the proposed experiment. Support for the experiment itself is not offered by NCAR but may be sought from the Air Force, Navy or NASA agencies. If NCAR approves the experiment, balloon and balloon facilities are made available for the experiment. It should be emphasized that logistics and time required for balloon-borne field operations should weigh heavily against such operations for undergraduate programs but need not preclude all such experiments.

Some of the many areas in which much more research is required, and often with relatively simple equipment, are listed below in summary:

1. Examination of terrestrial atmosphere in layers.
2. Height distribution of aerosols - distribution near the sun.
3. Polarization and scattering at large angles from the sun.
4. Atmospheric absorption as functions of altitude, latitude, zenith angle, time of day, time of year.
5. Photography and photometry of zodiacal light and aurorae.
6. Outer corona studies.
7. Polarization of starlight at very short wavelengths.

Programs that support balloon astronomy but are not actually flown, thereby becoming especially attractive to undergraduate programs, include:

1. How to minimize compound pendulum motion of balloons.
2. Study of optical properties of materials, including scintillation, X-ray darkening and fluorescence of materials. Index of refraction, absorption measurements in the ultraviolet for materials suitable for lenses.
3. Coronal investigations in the infrared.
4. Particle concentration and size measurements as a function of altitude.
5. Microwave studies of planets, stars and sun.
6. Atmospheric seeing and scintillation studies.

Suggestions for research in more general areas include:

1. Study of the amount of glass removed per unit time in a lens polishing operation.
2. Laser interferometry for long path measurements through the atmosphere.
3. Precision testing of small optical components (of the order of 0.01 wavelength).
4. Study of the lower atmosphere - transmission, slant-path transmission.
5. Study of the nature of coherent scattering and comparison with incoherent light scattering.
6. Infrared background noise.
7. Divergence of flux as a function of altitude.
8. Interferometry applied to measurement of earth tides.

It is to be noted that many of the above items are not at the forefront of science, and yet represent necessary experimentation from both the scientific and industrial points of view. This is particularly true for studies of optical materials.

It is suggested that OSA acquaint foundations and industries with the research potential of undergraduate institutions, and to urge their support of programs in their particular fields of interest.

NON-TECHNICAL:

Group IV presents as the general considerations of the problems facing the aspiring small college researcher the following, with order of listing not of significance:

1. Time
2. Space
3. Funds
4. Equipment
5. Lack of background
6. Lack of support from necessary supporting sources
7. Awareness of suitable problems

1. A survey of the members of Group IV showed that the required teaching load ranged from a minimum of twelve to a maximum of nineteen hours.

2. It was found that the requirements for a small beginning type of experimental research will not require an amount of space which cannot be found even in the most crowded of institutions. It is to be noted that the consensus of opinion was that the experiment should not necessarily be shut away in such a manner that no one except those directly concerned know that something is being done.

3. It was agreed that in all institutions the reduction in the amount of teaching would be accompanied by a corresponding reduction in salary. It is therefore felt that once a research program is in other than its initial stages it will be desirable for the researcher to seek contract support that would provide compensation for a reduction in salary.

4. Equipment needs have been successfully demonstrated to be slight or relievable by the full use of the opportunities of surplus equipment made available through the Department of Health, Education and Welfare.

5. The difficulty of a lack of background is being alleviated by such undertakings as the Institute of Optics at the University of Rochester and conferences with lectures in the field such as we have had at this Conference. Additionally, the attendance at professional organization meetings will keep the aspiring researcher near the forefront of modern Optics.

6. It was agreed that it is necessary to have the support from secondary sources. The types of support suggested here include the services of an adequate secretary, a machine shop and preferably a machinist, and an electronics technician. It has been suggested that it is occasionally possible to find one man who can serve as both a machinist and an electronics technician.

7. The final and foremost consideration which an aspiring small college researcher must face is the lack of communication. This communication should be interpreted in a very broad sense. First is the actual lack of direct communication with the full time researcher. Even if a part time research aspirant can keep up with the literature of the field, it is seldom that a publishing scientist will present negative data or discuss an experiment which needs further work and will be applicable to small research. Additionally, published data are generally from work which can be classified as coming from "the frontiers of science".

The desirable starting point for a small research project seems to be some of the problems which are by-passed or circumvented by researchers such as these. During this Conference several ideas have been proposed by active researchers. These ideas have been of passing interest, but because of more pressing research, necessary profit motive, or publishing and status requirements, have been dormant. These are the types of ideas that seem applicable for undergraduate research work.

The problem then seems to be one of communication. There is a gap between those who have the problems and not the time or inclination, and those who have these in the reverse order. It is not the desire to be spoon-fed by some outstanding researcher. The desire is that there should be better lines of communication.

To promote this information transfer the following ideas have been suggested:

A. The founding of a Research Newsletter. This would be similar to the AIP Resource Newsletter. An organization such as the OSA would serve as a clearing house for the passage of information of current research possibilities among the leading researchers and the smaller researchers.

B. Periodic meetings of the Participants of this Task IV Conference. This would perhaps lead to the formation, on a rather loose basis, of an organization similar to the founding of IRIS. The responsibility for the financial support could be either by the individual's institution or by NSF or other organization. If the individual institutions must supply the funds, establishment of realistic travel budgets is essential. The OSA could aid here by directly contacting college presidents, emphasizing the importance to their institutions of such investments.

C. The organization on a regional basis of those institutions who are desirous of information transfer. Those institutions in a given region would elect a representative for the period of one year. The task of this person would be to visit certain government, industrial, and university researchers, to sit down and discuss the state of the art for relatively short periods of time. He would visit, for perhaps a week or two during his term of office, a series of these researchers. During these visits he would compile a list of topics which are of interest to those he has visited. As payment for these visits he would have prime choice of these ideas. Tje remainder would be made available to those in his region whom he represents. The following year the task of the visitation would fall to a successor in the region. This rotating research coordinator would travel under the grace of the OSA, and would expect that the OSA would furnish him with the required credentials and introduction to those who are willing to talk over their interests and ideas with such a group. The cost os this program would be met by those institutions who are participating in its benefits.

Group IV recommends that suggestions A and B above be carefully considered as solutions, at least in part, to the problem of communications. And, if this indeed be the major problem, the stimulus provided by its alleviation may well lend itself to partial solution of the first six items above.

Finally, it is suggested that OSA write a clear, penetrating letter to the presidents of all colleges, pointing out the absolute necessity of maintaining adequate library facilities, including addition of new and pertinent periodicals, and of the value of the communication lines discussed above in terms of the colleges' responsibility to provide essential travel funds.

CONFERENCE ON UNDERGRADUATE RESEARCH PROGRAMS IN OPTICAL PHYSICS

GROUP "V" REPORT

I. INTRODUCTION

Group V has as one of its purposes in this Conference the preparation of a list of suggested experiments for a research program, an honors program, or a senior projects program in Optical Physics in the following 6 fields:

1. Optical Materials
2. Fiber Optics
3. Polarization
4. Thin Films
5. Optical Constants
6. Geometrical Optics

In considering these topics reference is made to the following papers that have been presented to this Conference:

1. Optical Materials, William Wolfe, University of Michigan
2. Fiber Optics, Dr. N. S. Kapany, Optics Technology
3. Thin Films, Dr. L. N. Hadley, Colorado State University

In considering the following suggestions, it is important to keep in mind that the project can develop over several years and can involve many students in succession. An initial project could be the construction of an optical instrument. Successive projects could involve its improvement, calibration and testing. Accessory equipment could be built. By spreading development over a period of time the cost per year of the instrument could be kept low and the instrument could be constructed with only a few students. It is with these ideas in mind that we suggest a representative list of instruments. Construction of any of these instruments would be a suitable undergraduate project.

After the instrument has been completed any number of experiments are possible. In Section III of this report, a sample of experiments relating to the subject matter of this Group is suggested. It should be kept in mind that the line between a student project and research is blurred. In many cases research involves only greater precision. In the case of many optical properties even imprecise knowledge is lacking. Useful contributions can be made to this body of knowledge with relatively little difficulty.

Thanks to the efforts of W. C. Connolly there is presented in Section IV a bibliography of articles in the American Journal of Physics relevant to the topics of Group V. These can serve as starting points for honors projects or research.

In Section V proposals are presented for future action to achieve the aims of this Conference.

II. INSTRUMENTS

1. Construction of a Fabry-Perot interferometer.
2. Construction of a Grating Spectrograph (e.g. Kessler)
3. Construction of an Optical Pyrometer.
4. Construction of optical instruments from surplus; e.g. projection equipment, telescopes, etc.
5. Building a ruby laser.
6. Design and construction of various interference filters, e.g. thin films.
7. Design and construction of a vacuum system (e.g. for thin film work)
8. Construction of a polarimeter.

9. Construction of a device particularly for measuring small degrees of polarization.

III. PROJECTS

1. Measurement of transmission, absorption, index of refraction, and reflectivity for solids, gases and liquids as a function of wavelength, temperature, pressure, etc.
   (a) Apparatus needed includes spectrometer, ellipsometer, wave plate.
   (b) For example of a measurement of index of refraction, see: Letter to Editor in J.O.S.A., February, 1961, by M. Laikin.
2. Optical Constants of Crystals

   Object: Measure n and k (index of refraction and absorption constant of srystals such as Fe_2O_3, $BaTiC_3$, CdS, TiO_2, ZnO and others that have an absorption peak in the visible. Compare results for k with those done by transmission method to see if the surface region is different, optically, from the bulk.

   Equipment: Ellipsometer (Gaertner $2750.), Carbon arc or photo spot light and interference filters (Fish - Shurman Corporation has them for $15 - $37.) For ultraviolet, a photomultiplier ($60.) and a microammeter (R. C. A. $110.) are needed.

   (See Vernon, J. Appl. Physics, 33, 2140 (1962)
3. Polarization of Diffusely Reflected Light

Object: To measure the extent to which partially reflected light is polarized for different materials, wavelengths and surface conditions.

Equipment: Ellipsometer (or polarimeter) and filters (as above) or perhaps instead of an Ellipsometer, polaroids, wave plate (and photomultiplier) might be sufficient.

4. Bifluorescence

   Object: Many crystals that fluoresce, fluoresce polarized light. Study of this light may help to identify the source of fluorescence.

   (See Ganguly and Chandburg, Physics Review 95, 1148 (1954)

5. Fluorescence of Optical Materials by Nuclear Radiations

   Object: Find out if optical glass and other materials will fluoresce when bombarded by Gamma or Beta rays. For a start, just use a photomultiplier (and microammeter), specimen and a radioactive source.

   (See Jet Propulsion Laboratory Reports, Cal. Tech.)

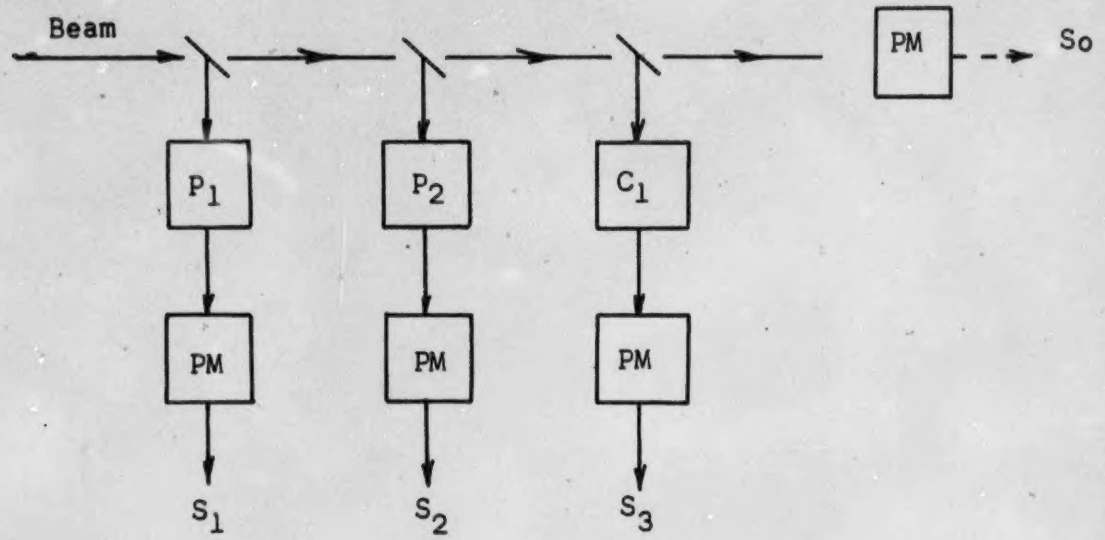
6. Measurement of interaction of polarized light with matter as a function of temperature, pressure, impurities, angle of incidence, etc.

7. Measurement of the degree of polarization of sources, i.e., Zeeman effect, Stark effect, bifluorescence, biemissivity, grazing emergence, etc.

   (Shurcliff, Polarized Light, Harvard U. Press, 1962, p. 161.)

8. The construction of a device to simultaneously measure the Stokes parameters[1] of a light beam is proposed using photomultiplier circuitry with beam splitting. It would be attempted using counting circuits rather than integrating

currents so that statistical analysis could be used to increase accuracy. Schematically the device would appear as in Figure 1.



P_1 Plane polarizer at 0° S_o, S_1, S_2, S_3 : Stokes Parameter

P_2 Plane polarizer at 45° PM: Photomultiplier and Counter Circuit

A less expensive device could be constructed using only two channels, the S_o channel with the P_1, P_2 and C_1 filter being placed in the second beam.

9. Study the Faraday effect.
10. Study the effects of polishing and grinding on the structure of the surface of optical materials. It may also be interesting to study the effect on other features.
11. Mechanical properties of optical materials: (glasses, glues, etc.)

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[1] Shurcliff: Polarized Light. Harvard (1962)

   a. Elastic Modulus
   b. Thermal effects in non-equilibrium situation when apparatus is being externally illuminated in a vacuum (satellite in space)
   c. Coefficient of thermal expansion
   d. Thermal conductivity
   e. Emissivity
   f. Homogeneity of optical elements.
   g. Hardness

12. Study of mirror support structures.

13. Measurement of thermal waves in optical materials by observing the spatial change in the index of refraction as a function of time.

14. With the introduction of gratings, commercial infrared spectrometers have increased spectral range from 4000 cm^{-1} to 250 or 200 cm^{-1}. The only clear window materials are CsBr or CsI which are soft and very hygroscopic. It should be possible to coat these materials with a thin film of a material like MgF_2 which would make them moisture resistant yet not affect their transmission. B_2O_3 forms a glass which reacts with H_2O. It might be useful to see if the glass could be protected by thin film coatings.

15. Transmission and absorption in filters as a function of temperature.

16. Measurement of anisotropic properties of films (or anything else for that matter, e.g. birefringence)

17. Thin films: Determine the following:

    1. Disperson curves for metals
    2. Reflectance, transmittance of metallic films and semiconducting films
    3. Reflectance, and transmittance of dielectric films
    4. Variation of the above with temperature of the sample
    5. Variation with respect to temperature of the substrate during deposition of the film
    6. Variation with respect to time (and pressure) following the deposition of the film.
    7. Variation with respect to rate of formation of film
    8. Variation with thickness of sample
    9. Investigate for possible relationships between the above optical properties of metallic films and their electrical properties.
    10. Try to determine why some metals such as zinc must bounce several times before they will stick to the surface.
    11. Measurement of N and K for thin films. As a reference for thin films see Physics of Thin Films ed. by G. Hass, Academic Press, 1963.
    12. Study of magneto-optic effects, e.g. the use of Voigt and Faraday effects to determine effective masses. (Variation of absorption with magnetic field, magneto reflection and study of intraband and interbond structures.)
    13. Study of behavior of the coefficients of non-linear optical effects as a function of temperature, pressure, frequency, and impurity concentration using a laser.

IV. BIBLIOGRAPHY

1. "Studies of Transmission Zone Plates by O. E. Myers, Jr., Vol. 19 No. 6, Sept. 51, page 359

   Using Fresnel zone plate as a lens to focus wavelengths from infrared to soft X-rays

2. "Electronic Magnifier for Observation of Infrared and Ultraviolet" by Z. V. Harvalik, Vol. 18, No. 3, March 1950, page 151

   Use of spectroscope from 3000 to 11,500 A^{o}.

3. "Caustics by Reflection in a Concave Spherical Reflecting Surfaces" by G. F. Herrenden-Hacker, Vol. 16, No. 5, May 48, page 272

   Plotting caustic curves from derived formulae.

4. "Caustic curves by Geometric Construction" by Newell and Baez, Vol. 17, No. 3, March 19, page 145

5. "Experimental Approach to the Paraxial Properties of Lens Systems" by F. D. Cruickshank, Vol. 17, No. 4, Apr. 49, page 204

   (Good geometrical optics experiment involving virtual images)

6. "Experimenting with Virtual Images" by B.I.H. Scott, Vol. 17, No. 4, Apr. 19, page 209

7. "Analysis and Synthesis of Optical Images" by J. E. Rhodes, Jr., Vol. 21, No. 5, May 53, page 337

   (Good starting point for a theoretical project using a double Fourier Transform)

8. "Refractions by a Thick Lens Which is Equivalent to a Compound Lens System" by M. E. Hufford, Vol. 14, No. 4, July - Aug. 46, page 259

9. "Fresnel Diffraction Experiment" by L. A. Sanderman and R. S. Bradford, Vol. 17, No. 8, No. 49, page 514

10. "A Correction to the Treatment of Fresnel Diffraction" by C. L. Andrews, Vol. 19, No. 5, May 51, page 280

11. "Optical-Lever Amplifier for Studying Brownian Motion of a Galvanometer" by K. W. White, Vol. 31, No. 12, Dec. 63, page 922
    (Measure Boltzmann's Constant)

12. "Construction and Use of a Fabry-Perot Interferometer" by W. A. Hilton, Vol. 30, No. 10, Oct. 62, page 724
    (Measure index of refraction of gases and Zeeman effect)

13. "Photography-High Speed Using General Radio 1531-A Strobotac" by Eldridge, Skinner, and Tsepas, Vol. 30, No. 12, Dec. 62, page 921
    (Could be the start for an interesting project)

14. "Experiments on the Laws of Light Absorption" by Bluh and Ko, Vol. 22, No. 5, May 54, page 306
    (Vary depth of liquid - absorption and half value layer)

15. "A Simple X-Ray Diffraction Camera" by W. C. Campbell, Vol. 15, No. 5, Sept.-Oct. 47, page 409

16. "Optical Methods for the Determination of Flame Temperatures" by S. S. Penner, Vol. 17, No. 7, Oct. 49, page 422
    (Pyrometry and infrared work - Two color and line reversal techniques)

17. "Photon Diffraction - Undergraduate Research Project" by R. H. Biser, Vol. 31, No. 1, page 29, Jan. 1963

18. "Physics of the Glassy State" by E. U. Condon, Vol. 22, No. 5, May 1954, page 310
    (Thermoluminescence - phosphorescence material heated -

glows brightly)
(Solarization - color change by sunlight on glass
- photosensitive glass)

19. "Photosensitive Glass" by Riess, Bosch, and Reboul, Vol. 16, No. 7, Oct. 48, page 399
(Study of Corning Glass - Expose by ultraviolet 310-340 m and develop by heat (565°C)).

20. "Diffraction by Two Non-Coplanar Obstacles" by C. F. Ellis, Vol. 16, No. 1, Jan. 48, page 8

21. "Diffraction by Two Non-Coplanar Straight Edges" by J. R. Heirtzler, Vol. 17, No. 7, Oct. 49, page 449
Also see letter H. A. Nye in Vol. 17, No. 7

22. "C. V. Bays's Rainbow Cup and Experiments with Thin Films" by J. Satterly, Vol. 19, No. 8, Sept. 51, page 448
(Good qualitative experiment for starting thin film study)

23. "Vel. of Light Measurement through μ_0, ε_0", by W. E. Stephens, Vol. 3, No. 2, Feb. 63, page 105

V. RECOMMENDATIONS FOR FUTURE ACTION

1. If there is as much concern for the lack of information about optical constants as has been voiced at this Conference, a data tabulation center should be established. Such a center could be modeled on the Nuclear Data Group headed by K. Way and supported by the Federal government. This group served an extremely valuable function as an information center for nuclear physicists. A similar optical constants group would satisfy the needs suggested in the following by Edward Speyer.

"I think there would be an enthusiastic roar of approval from the entire scientific community if a handbook of optical materials were to become available. Tables and charts of reflectivities, refractive indices, transmissivities, and absorptivities would be provided for all materials used as mirrors, lenses, prisms, or windows. A separate section might be included with emissivities, although spectral line information could be omitted since it is presently available.

For example, with respect to reflectivity of a given metal, a semi-log graph might give reflectivity vs. wavelength for the whole spectral range from x-rays to radar. Tables could give more accurate values for the spectral regions of greatest interest and most rapid variation. And a page of text might give references, notes as to thickness and preparation of the metal layer, aging considerations, peculiarities of the given metal, etc.

The State-of-the-Art Report for Optical Materials for Infrared Instrumentation, issues by the University of Michigan, is a start in the direction I am suggesting. The neutron cross section compilations issued by the Atomic Energy Commission are an analogous effort in another field of physics. Perhaps the Bureau of Standards might set up a laboratory for the optical data compilations, to help keep the data consistent."

2. To make it easier to start on the projects suggested in Section II, a bibliography should be published. The bibliography should give references to books and articles describing design and construction of optical instruments such as have

been suggested. Some indication could be given of where various glasses and materials might be obtained.

3. To further student and teacher interest in optics it is proposed that the Optical Society establish a competition for papers describing honors projects. The awards are to be:

    (a) publication of several papers of highest merit in a journal of the Optical Society

    (b) a significant award to the student or students for the best project

    (c) an equipment prize for the professor supervising the research. Perhaps some element of the optical industry will be interested in sponsoring this competition.

4. Some provision should be made to further develop the research capability of the faculty of small colleges. This is a difficult problem because of extreme variations in level of competence and commitment. Group V proposes:

    (a) The establishment of a correspondence course for faculty in intermediate optics. This course to be financed partly by those groups interested in furthering the development of optics and partly by enrollment fees. The course should be administered by The Johns Hopkins or Rochester University or some similar institution where optics is well established as a discipline.

(b) There should be an NSF sponsored Summer Institute or Conference in optics. This Conference or Institute might serve as the culmination of the above correspondence course. It might serve to provide an intensive introduction to optics in the laboratory. In this way nascent researchers could become acquainted with standard techniques and instruments of optics.

(c) For those individuals more prepared to do research existing programs may suffice to get them started. The Science Faculty Fellowship programs would provide funds for a clearly formulated program of research. NSF Research Participation for College Teachers Program would be particularly useful. This program requires submission of programs from "universities and colleges granting Ph.D. degrees, and field stations and independent research laboratories that are either affiliated with an institution granting the doctoral degree, or that conduct research of a caliber equivalent to that normally required for this degree." Not many of these programs are being submitted.

The OSA and others interested in furthering research in optics should strongly urge Rochester University, Johns Hopkins, Pennsylvania State University, the University of Wisconsin, University of Michigan and other institutions where research is being done to submit proposals which would enable college teachers to participate in research at these institutions.

Information about existing proposals should be widely distributed, particularly to the Participants of this Conference.